FINAL
AS-BUILT BASELINE
MONITORING REPORT (MY0)

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, North Carolina

DMS Project ID No. 100014
Full Delivery Contract No. 7192
USACE Action ID No. SAW-2017-01471
DWR No. 17-0290
RFP No. 16-006990

Cape Fear River Basin
Cataloging Unit 03030002

Data Collection: February – May 2019
Submission: May 2019

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

June 3, 2019

Ms. Lindsay Crocker
NC DEQ – Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina
27699-1652

Subject: Heron Stream and Wetland Mitigation Site: As-built DMS comment response
DMS Contract #: 7192; DMS Project ID: 100014; RFP # 16-006990

General:
1. If RS is petitioning to use as-built for mitigation credits, please provide a memo request to amend the Mitigation Plan and provide detailed information on the differences between Mitigation Plan assets and as-built assets. Add a column to Table 1 (Appendix) to show Mitigation Plan assets. There will likely be questions as to why some of the EII areas changed from the Mitigation Plan. Provide justification in this memo to IRT.
A petitioning letter is attached. In addition, a column was added to Table 1 (Appendix A) containing Mitigation Plan footages.
2. CCPV- Figure 2, label stream reaches on overview map that includes all project polygons and figures 2A-D. Revise stream shown on map to break out by restoration level and label reaches to match Reach ID on Table 1.
Figure 2, and 2A to 2D have been updated.

Specific Comments/Questions:
1. Page 4, last paragraph, the explanation of deviations from Mitigation Plan are great, but do not explain all of the increases in stream footage from Mitigation Plan.
More specific information was added to this paragraph to explain all increases and decreases in stream footage from Mitigation Plan. Specifically, UT 2 was added to the discussion of mitigation footage changes.
2. Appendix Page 3, table 2, add dates of MY0 Monitoring.
MY0 Monitoring was added to Table 2 (Appendix A).
3. Table 5, Appendix. How is it that you planted 1,297 stems/acre but all your vegetation plots are showing about half that amount? Is this accurate?
The average stems/acre across the Site planted is 1297; however, most of the Site was planted at a density of 680 stems/acre with the exception of the stream-side assemblage and marsh treatment areas, which were planted at a density of 2720 stems/acre.
4. As Built Drawings: please have your engineer and surveyor sign the final as-built plans.
As built drawings and plans have been signed by the engineer and surveyor.

Thank you,

Worth Creech

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Prepared by:

Restoration Systems, LLC
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Raleigh, North Carolina 27604
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919-755-9490 (phone)
919-755-9492 (fax)

And

Axiom Environmental, Inc.
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Raleigh, North Carolina 27603
Contact: Grant Lewis
919-215-1693 (phone)

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APPENDICES

1.0 PROJECT SUMMARY

Restoration Systems, LLC has established the North Carolina Division of Mitigation Services (NCDMS) Heron Stream and Wetland Restoration Site (Site).

1.1 Project Goals & Objectives

Project goals were based on the *Cape Fear River Basin Restoration Priorities* (RBRP) report (NCEEP 2009) and on-site preconstruction data collection of channel morphology and function observed during field investigations. The Site is located within Targeted Local Watershed (TLW) 03030002050050. The RBRP report documents benthic ratings vary between "Fair" and "Good-Fair" possibly due to cattle, dairy, and poultry operations. The project is not located in a Regional or Local Watershed Planning Area; however, RBRP goals addressed by project activities are as follows with Site specific information following the RBRP goals in parenthesis.

1. Reduce and control sediment inputs (sediment input reduction of 67.3 tons/year);
2. Reduce and manage nutrient inputs (livestock removed from streams, elimination of fertilizer application, installation of marsh treatment areas; and a direct reduction of 893.2 pounds of nitrogen and 47.0 pounds of phosphorus per year);

Site specific mitigation goals and objectives were developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) analyses of preconstruction and reference stream systems at the Site (NC SFAT 2015 and NC WFAT 2010) (see Table 1).

Stream/Wetland Targeted Functions, Goals, and Objectives

Targeted Functions	Goals	Objectives	Compatibility of Success Criteria
(1) HYDROLOGY			
(2) Flood Flow (Floodplain Access) (3) Streamside Area Attenuation (4) Floodplain Access (4) Wooded Riparian Buffer (4) Microtopography	• Attenuate flood flow across the Site. • Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Deep rip floodplain soils to reduce compaction and increase soil surface roughness • Protect riparian buffers with a perpetual conservation easement	• BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
(3) Stream Stability (4) Channel Stability (4) Sediment Transport	• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Remove livestock • Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer	• Cross-section measurements indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and structures • BHR not to exceed 1.2 • ER of 1.4 or greater • < 10% change in BHR and ER in any given year • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY			
(2) Streamside Area Vegetation (3) Upland Pollutant Filtration (3) Thermoregulation (2) Indicators of Stressors Wetland Particulate Change Wetland Physical Change	• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Install marsh treatment areas • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams • Provide surface roughness through deep ripping/plowing • Restore overbank flooding by establishing proper channel dynamics • Cessation of municipal land application	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria
(1) HABITAT			
(2) In-stream Habitat (3) Substrate (3) Stream Stability (3) In-Stream Habitat (2) Stream-side Habitat (3) Stream-side Habitat (3) Thermoregulation Wetland Landscape Patch Structure Wetland Vegetation Composition	• Improve instream and stream-side habitat.	• Construct stable channels with cobble/gravel substrate • Plant woody riparian buffer to provide organic matter and shade • Construct new channel at historic floodplain elevation to restore overbank flows and plant woody riparian buffer • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams	• Cross-section measurement indicate a stable channel with cobble/gravel substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded

1.2 Project Background

The Heron Stream and Wetland Mitigation Site (hereafter referred to as the "Site") encompasses a 17.64-acre easement along warm water, unnamed tributaries to Pine Hill Branch and unnamed tributaries to South Fork Cane Creek. The Site is located approximately 4 miles southeast of Snow Camp and 4.5 miles north of Silk Hope in southern Alamance County near the Chatham County line (Figure 1, Appendix A).

Prior to construction, Site land use consisted of disturbed forest and agricultural land used for livestock grazing and hay production. Livestock had unrestricted access to Site streams, which had been cleared, dredged of cobble substrate, straightened, trampled by livestock, eroded vertically and laterally, and received extensive sediment and nutrient inputs from stream banks and adjacent pastures. Approximately 62 percent of the stream channel had been degraded contributing to sediment export from the Site resulting from mechanical processes such as livestock hoof shear. In addition, streamside wetlands were cleared and drained by channel downcutting and land uses. Preconstruction Site conditions resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities restored riffle-pool morphology, aided in energy dissipation, increased aquatic habitat, stabilized channel banks, and greatly reduced sediment loss from channel banks.

1.3 Project Components and Structure

Proposed Site restoration activities generated 5293 Stream Mitigation Units (SMUs) and 0.66 Wetland Mitigation Units (WMUs) as the result of the following.

- 4068 linear feet of Priority I stream restoration
- 1184 linear feet of stream enhancement (Level I)
- 1090 linear feet of stream enhancement (Level II)
- 0.35 acre of riparian wetland restoration
- 0.61 acre of riparian wetland enhancement

Additional activities that occurred at the Site included the following.

- Installation of six marsh treatment areas throughout the Site.
- Fencing the entire conservation easement by leaving some pre-existing fencing, removing fencing, and installing additional fencing.
- Planting 12 acres of the Site with 16,000 stems (planted species and densities by zone are included in Table 5 [Appendix C]).

Deviations from the construction plans included realignment of UT 1B (adding 20 linear feet to the alignment) due to conflicts with a gas line crossing. The realignment resulted in the reduction of a log vane and alterations to pipe configurations within the crossing. Gas line realignment also affected the length of UT 2 in its lower reaches (shortening the Restoration reach). UT 2 also has minor deviations in the enhancement II reach due to profile elevation alterations to tie to the invert of UT 1B. These profile alterations were included in construction plans, but not included in table

updates of the detailed plan. Profile alterations resulted in the Enhancement (level II)/Restoration initiation point migrating upstream, and thus the length of the Enhancement (Level II) reach (UT 2A) decreased by 39 feet, and the length of the restoration reach (UT 2B) increased by 17 feet.

Minor easement deviations after construction plan development resulted in some stationing changes, most notable at the upper reaches of UT 1A (adding 5 linear feet to the alignment) and UT 8A & UT8B (reducing the alignments by a total of 4 linear feet). The easement variations also affected channel lengths across gas lines, which do not generate mitigation credit. Eight log cross-vanes were not constructed due to contact with bed rock, or conflicts with the gas line. In addition, a marsh treatment area was added to the right bank of UT 6 at a draw that was concentrating surface drainage and scouring the valley walls. No other deviations of significance occurred between construction plans and the as-built condition. In addition, no issues have arisen since construction occurred.

Site design was completed in July 2018. Construction started on November 27, 2018 and ended within a final walkthrough on February 11, 2019. The Site was planted on February 21, 2019. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 1-4 (Appendix A).

1.4 Success Criteria

Project success criteria have been established per the October 24, 2016 NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*. Monitoring and success criteria relate to project goals and objectives. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. The following table summarizes Site success criteria.

Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Continuous surface flow must be documented each year for at least 30 consecutive days. Surface water monitoring gauges will be installed in the upper third of all intermittent channels, unless otherwise requested by the IRT. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. • Entrenchment ratio (ER) must be no less than 2.2 for E- and C-type channels at any measured riffle cross-section. Note: B-type channels may have an ER less than 1.4. • BHR and ER at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period. • The stream project shall remain stable and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 10 percent of the growing season, during average climatic conditions. Note: Soil temperature for growing season establishment will be measured daily utilizing a continuous monitoring soil probe. Soil temperature will be measured from mid-February through the end of April (at a minimum).
Vegetation
• Within planted portions of the site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7. • Trees must average 7 feet in height at year 5, and 10 feet in height at year 7 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis.

2.0 METHODS

Monitoring requirements and success criteria outlined in this plan follow the October 24, 2016 NC Interagency Review Team *Wilmington District Stream and Wetland Compensatory Mitigation Update*. Monitoring will be conducted by Axiom Environmental, Inc. Annual monitoring reports of the data collected will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected. The monitoring schedule is summarized in the following table.

Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	■	■	■		■		■
Wetlands	■	■	■	■	■	■	■
Vegetation	■	■	■		■		■
Macroinvertebrates			■		■		■
Visual Assessment	■	■	■	■	■	■	■
Report Submittal	■	■	■	■	■	■	■

2.1 Monitoring

The monitoring parameters are summarized in the following table.

Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 37 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern to be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Total of 10 surface water gauges	Surface water data for each monitoring period as depicted in Figures 10A-10D.
Bankfull Events	Continuous monitoring surface water gauges and/or trail camera	Continuous recording through monitoring period	Total of 10 surface water gauges: One gauge on UT1, 2, 3, 6 and 8. Two gauges on UT 5. Three gauges on UT 7	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through monitoring period	All restored stream channels	Visual evidence, photo documentation, and/or rain data.
Benthic Macroinvertebrates	"Qual 4" method described in *Standard Operating Procedures for Collection and Analysis of Benthic Macroinvertebrates, Version 5.0* (NCDWR 2016)	Pre-construction, Years 3, 5, and 7 during the "index period" referenced in *Small Streams Biocriteria Development* (NCDWQ 2009)	2 stations (one at the lower end of UT1 and one at the lower end of UT5)	Results* will be presented on a site-by-site basis and to include a list of taxa collected, an enumeration of *Ephemeroptera, Plecoptera,* and *Tricopetera* taxa as well as Biotic Index.
Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	As-built, Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-October 22	6 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation, Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	14 plots spread across the Site	Species, height, planted vs. volunteer, stems/acre
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	4 plots randomly selected each year	Species and height

*Benthic Macroinvertebrate sampling data will not be tied to success criteria; however, the data may be used as a tool to observe positive gains to in-stream habitat

3.0 REFERENCES

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Appendix A
Background Tables

Table 1. Project Components and Mitigation Units
Table 2. Project Activity and Reporting History
Table 3. Project Contacts Table
Table 4. Project Attributes Table

Table 1. Project Components and Mitigation Credits
Heron Restoration Site

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Restoration Footage/ Acreage	Restoration Level	Restoration or Restoration Equivalent	Mitigation Ratio	Mitigation Credits	Comment
UT 1A	(-)0+05 to 04+70	475	470	475	Enhancement (Level I)	475	1.5:1	317	
UT 1B	04+70 to 13+26	753	836	856	Restoration	856-57= 799	1:1	799	57 lf of UT1 is located outside of the conservation easement and therefore is not generating credit
UT 2A	00+00 to 03+04	304	343	304	Enhancement (Level II)	304	2.5:1	122	
UT 2B	03+04 to 03+67	19	46	63	Restoration	63	1:1	63	
UT 3	00+00 to 02+79	269	279	279	Restoration	279	1:1	279	
UT 4	00+00 to 04+50	485	450	450	Restoration	450	1:1	450	
UT 5A	00+00 to 09+52	422	952	952	Restoration	952-52= 900	1:1	900	52 lf of UT5 is located outside of the conservation easement and therefore is not generating credit
UT 5B	09+52 to 14+90	538	538	538	Enhancement (Level II)	538	2.5:1	215	
UT 6	00+00 to 07+81	683	781	781	Restoration	781	1:1	781	
UT 7A	00+00 to 02+32	0	232	232	Restoration	232-41= 191	1:1	191	41 lf of the UT7 restoration reach is located outside of the conservation easement and therefore is not generating credit
UT 7B	02+32 to 09+96	764	764	764	Enhancement (Level I)	764-55= 709	1.5:1	473	55 lf of the UT7 enhancement reach is located outside of the conservation easement and therefore is not generating credit
UT8A	00+04 to 06+09	549	607	605	Restoration	605	1:1	605	
UT 8B	06+09 to 08+57	248	250	248	Enhancement (Level II)	248	2.5:1	99	
Wetland R	Riparian Riverine	--	0.35	0.35	Restoration	0.35	1:1	0.35	Wetland Restoration
Wetland E	Riparian Riverine	0.61	0.61	0.61	Enhancement	0.61	2:1	0.31	Wetland Enhancement

Table 1. Project Components and Mitigation Credits (continued)
Heron Restoration Site

Length & Area Summations by Mitigation Category		
Restoration Level	**Stream (linear footage)**	**Riparian Wetland (acreage)**
Restoration	4068*	0.35
Enhancement (Level I)	1184**	--
Enhancement (Level II)	1090	--
Enhancement	--	0.61

*An additional 150 linear feet of stream restoration is located outside of the conservation easement and is therefore not included in this total or in mitigation credit calculations.

**An additional 55 linear feet of stream enhancement (level I) is located outside of the conservation easement and is therefore not included in this total or in mitigation credit calculations.

Overall Assets Summary	
Asset Category	**Overall Credits**
Stream	**5293**
Riparian Riverine Wetland	**0.66**

Table 2. Project Activity and Reporting History
Heron Restoration Site

Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Technical Proposal (RFP No. 16-006990)	January 11, 2017	January 11, 2017
Institution Date (NCDMS Contract No. 100014)	--	May 22, 2017
404 Permit	--	October 10, 2018
Mitigation Plan	--	July 2018
Construction Plans	--	July 17, 2018
Site Construction	--	November 27, 2018-February 11, 2019
Planting	--	February 21, 2019
As-built Baseline Monitoring (MY0)	February-March 2019	May 2019

Table 3. Project Contacts Table
Heron Restoration Site

Full Delivery Provider	Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Worth Creech 919-755-9490
Designer	Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693

Table 4. Project Attribute Table
Heron Restoration Site

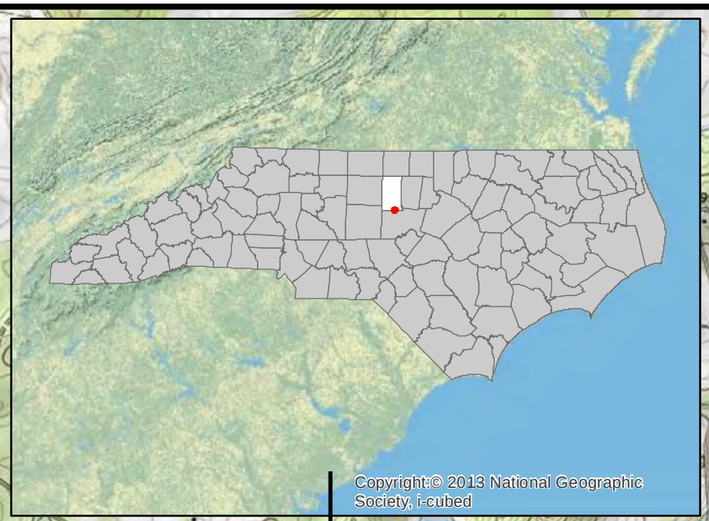
Project Information	
Project Name	Heron Restoration Site
Project County	Alamance County, North Carolina
Project Area (acres)	17.64
Project Coordinates (latitude & latitude)	35.853955ºN, -79.363458ºW
Planted Area (acres)	12.05
Project Watershed Summary Information	
Physiographic Province	Piedmont
Project River Basin	Cape Fear
USGS HUC for Project (14-digit)	03030002050050
NCDWR Sub-basin for Project	03-06-04
Project Drainage Area (acres)	14 to 96
Percentage of Project Drainage Area that is Impervious	<2%
CGIA Land Use Classification	Managed Herbaceous Cover & Mixed Upland Hardwoods

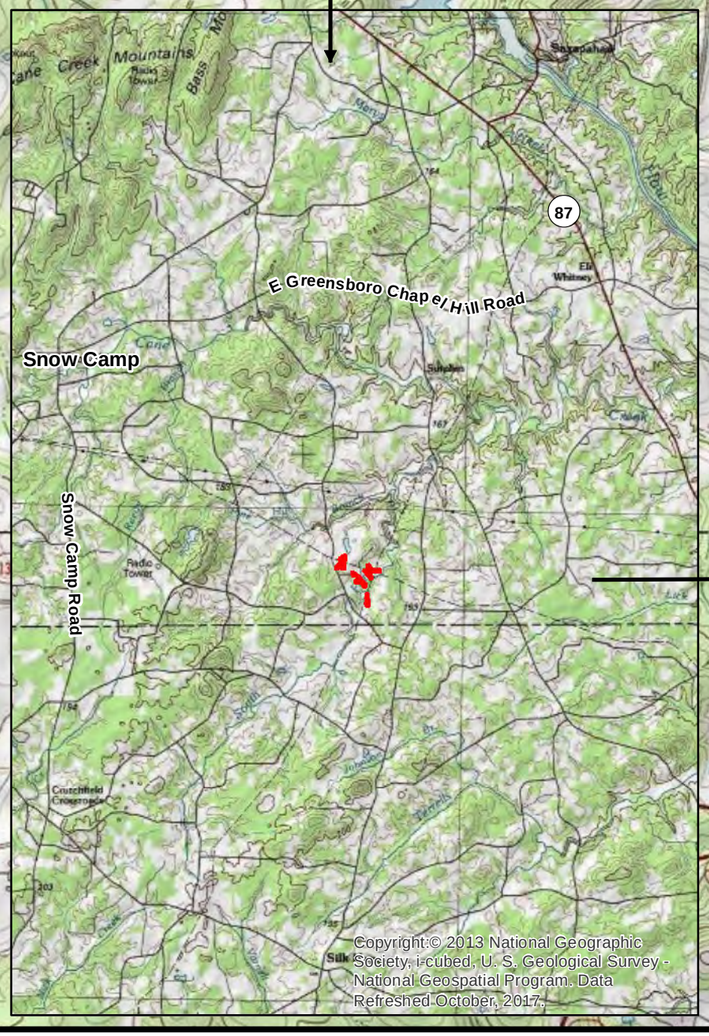
Section 4. Project Attribute Table
Heron Restoration Site (continued)

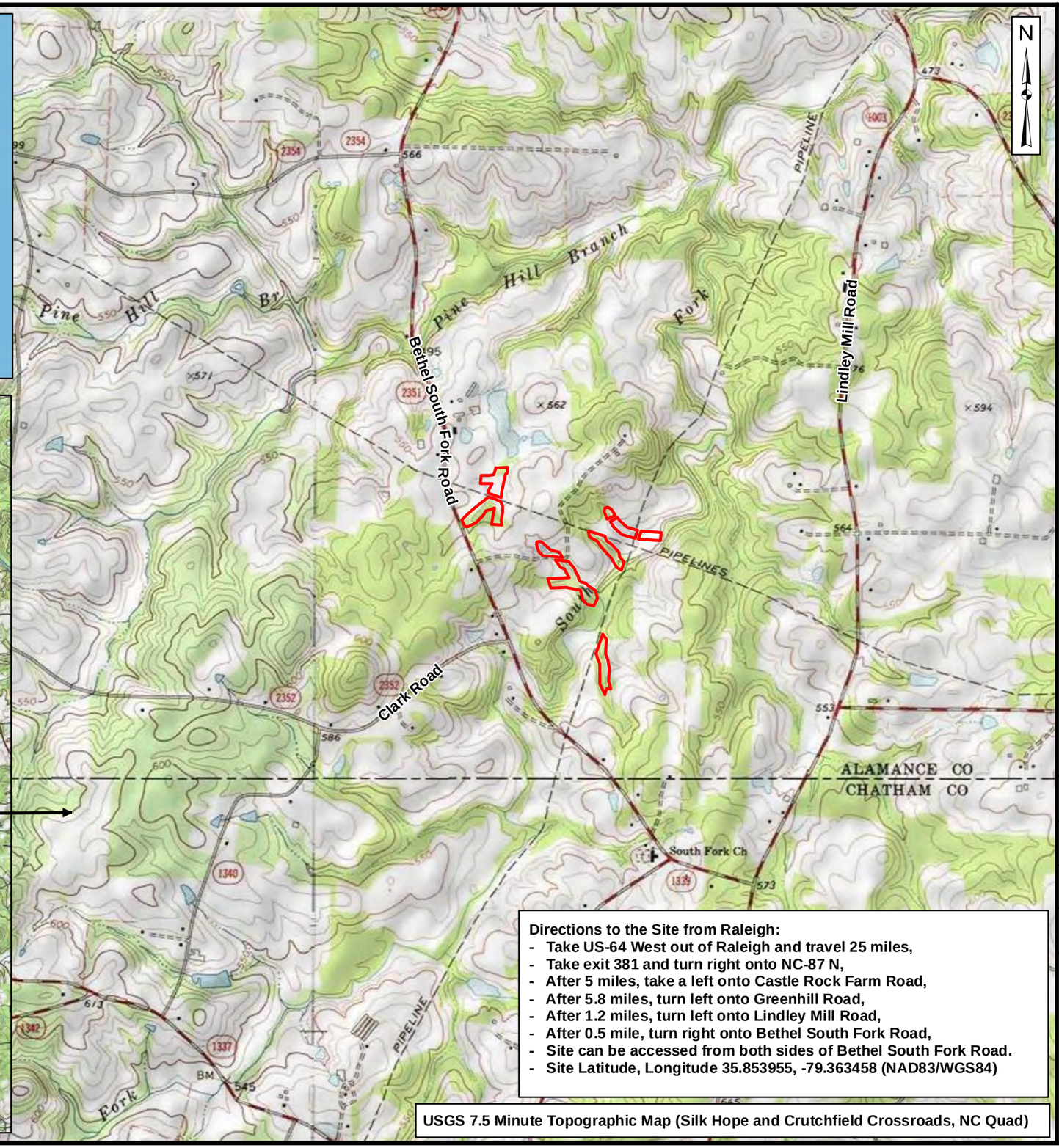
Reach Summary Information								
Parameters	**UT1**	**UT2**	**UT 3**	**UT4**	**UT 5**	**UT6**	**UT 7**	**UT 8**
Length of reach (linear feet)	1155	363	269	485	907	683	202	1221
Valley Classification & Confinement	Alluvial, confined							
Drainage Area (acres)	96.4	7.1	11.7	17.2	38.1	14.1	20.9	30.8
NCDWR Stream ID Score	30.5	22.5	28.5	33.5	27.5	23.5	24.5	27.5
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial/ Intermittent	Perennial	Perennial/ Intermittent	Perennial/ Intermittent	Intermittent	Perennial
NCDWR Water Quality Classification	WS-V, NSW							
Existing Morphological Description (Rosgen 1996)	Cg5	Gf5	Cg5	Eg5	Eg5	Cg5	Cg5	Eg5
Proposed Stream Classification (Rosgen 1996)	C/E 4	Gf 5	C/E 4	C/E 4	C/E 4	C/E 4	Eb4	C/E 4
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	I/III/IV	III/IV	II/III	II/III	III/IV	III/IV	II/III
Underlying Mapped Soils	Alamance silt loam, Georgeville silt loam, Goldston slaty silt loam, Herndon silt loam, Orange silt loam, Worsham sandy loam, Local Alluvial Land,							
Drainage Class	Well-drained, well-drained, well-drained, well-drained, well drained, poorly-drained, poorly-drained							
Hydric Soil Status	Nonhydric, nonhydric, nonhydric, nonhydric, nonhydric, hydric, hydric, respectively							
Valley Slope	0.0074	0.0270	0.0222	0.0244	0.0358	0.0300	0.0255	0.0218
FEMA Classification	NA							
Native Vegetation Community	Piedmont Alluvial Forest/Dry-Mesic Oak-Hickory Forest							
Watershed Land Use/Land Cover (Site)	43% forest,55% agricultural land, <2% low density residential/impervious surface							
Watershed Land Use/Land Cover (Cedarock Reference Channel)	65% forest, 30% agricultural land, <5% low density residential/impervious surface							
Percent Composition of Exotic Invasive Vegetation	<5%							

Appendix B
Visual Assessment Data

Figure 1. Project Location
Figures 2 & 2A-2D. Current Conditions Plan View
Vegetation Plot Photographs







Directions to the Site from Raleigh:
- **Take US-64 West out of Raleigh and travel 25 miles,**
- **Take exit 381 and turn right onto NC-87 N,**
- **After 5 miles, take a left onto Castle Rock Farm Road,**
- **After 5.8 miles, turn left onto Greenhill Road,**
- **After 1.2 miles, turn left onto Lindley Mill Road,**
- **After 0.5 mile, turn right onto Bethel South Fork Road,**
- **Site can be accessed from both sides of Bethel South Fork Road.**
- **Site Latitude, Longitude 35.853955, -79.363458 (NAD83/WGS84)**

USGS 7.5 Minute Topographic Map (Silk Hope and Crutchfield Crossroads, NC Quad)

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

PROJECT LOCATION

Drawn by: KRJ

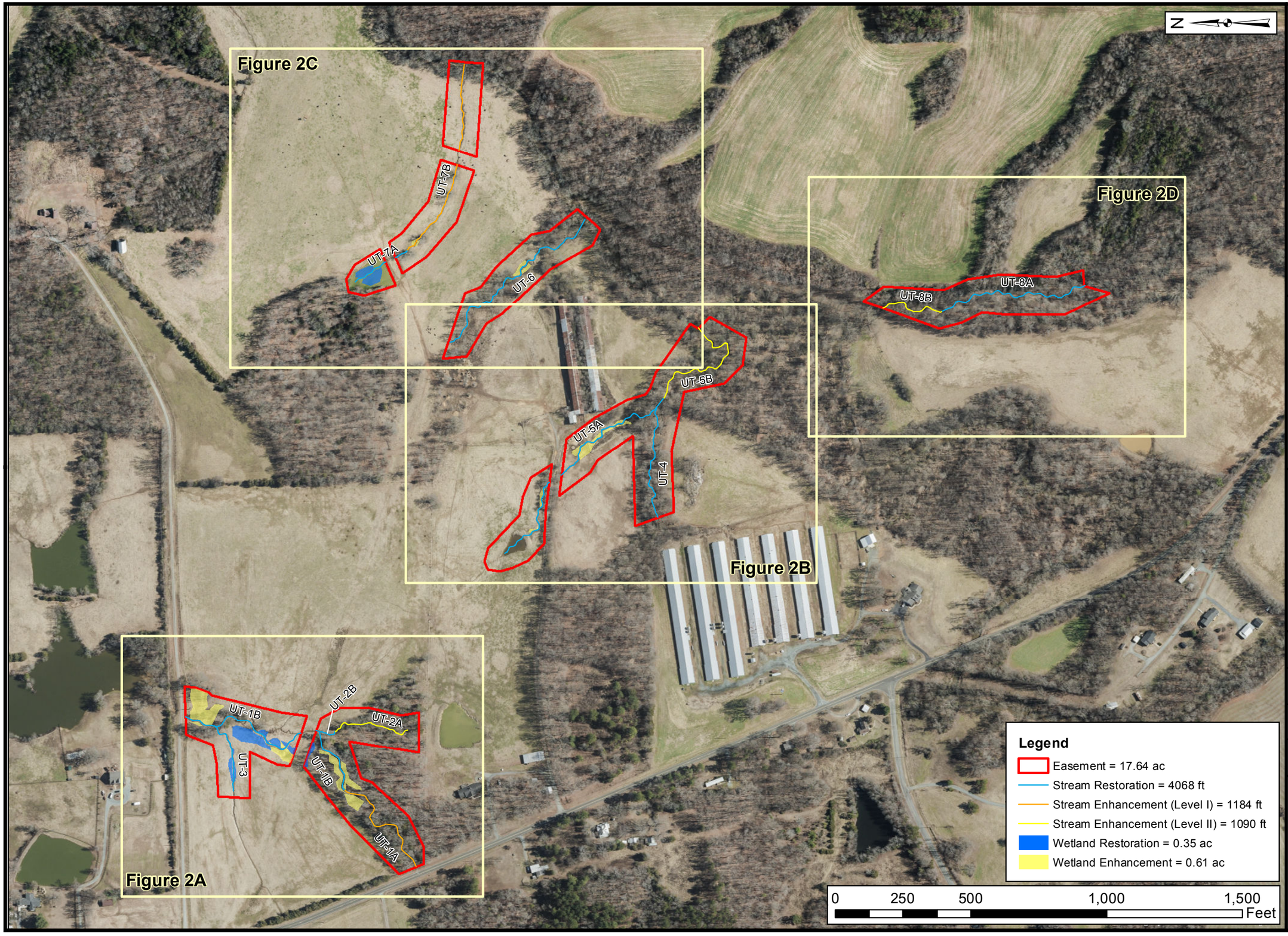
Date: DEC 2017

Scale: 1:20000

Project No.: 17-008

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

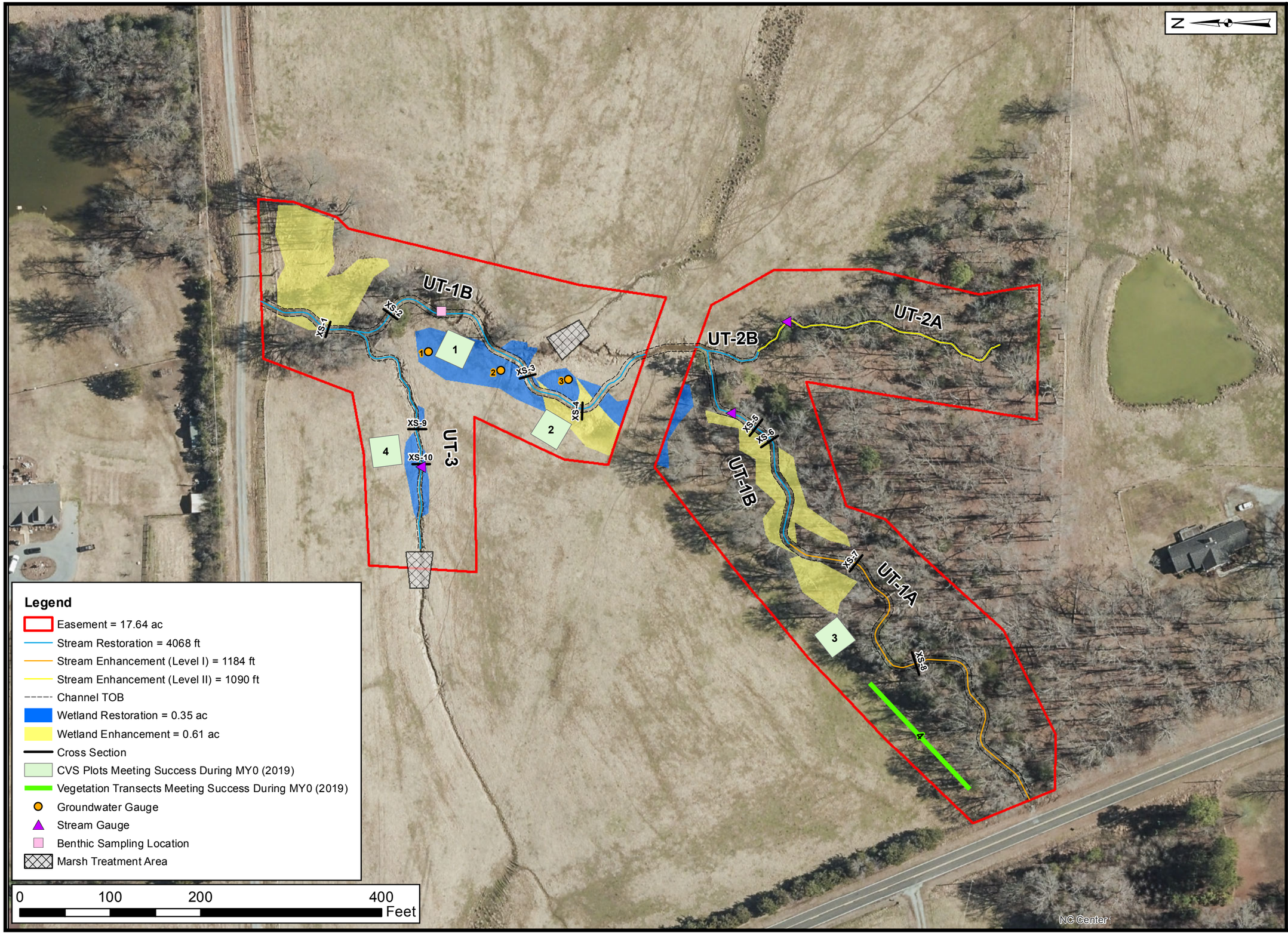
Date: MAY 2019

Scale: 1:4000

Project No.: 17-008

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

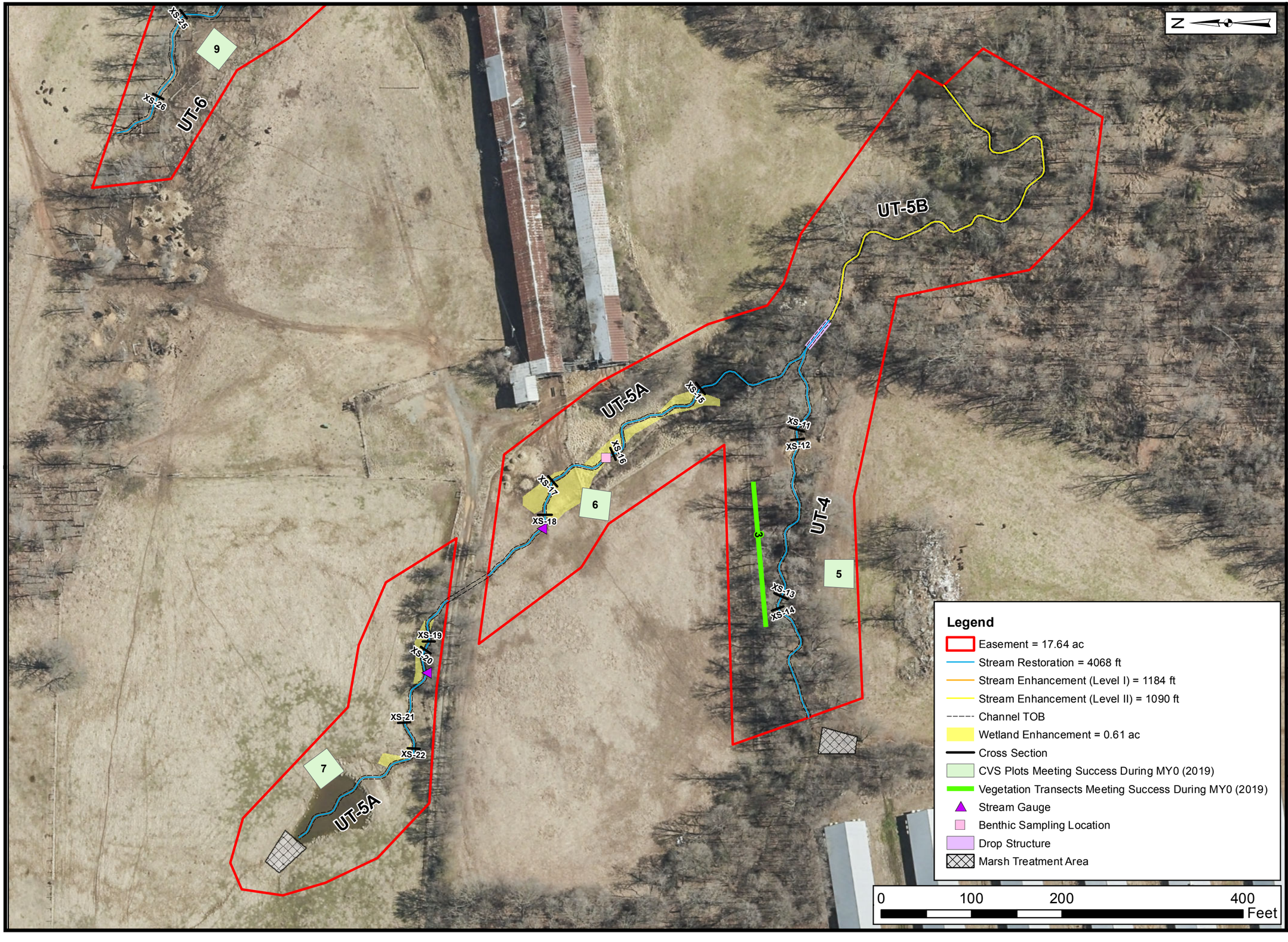
Date: MAY 2019

Scale: 1:1200

Project No.: 17-008

FIGURE

2A



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

Date: MAY 2019

Scale: 1:1200

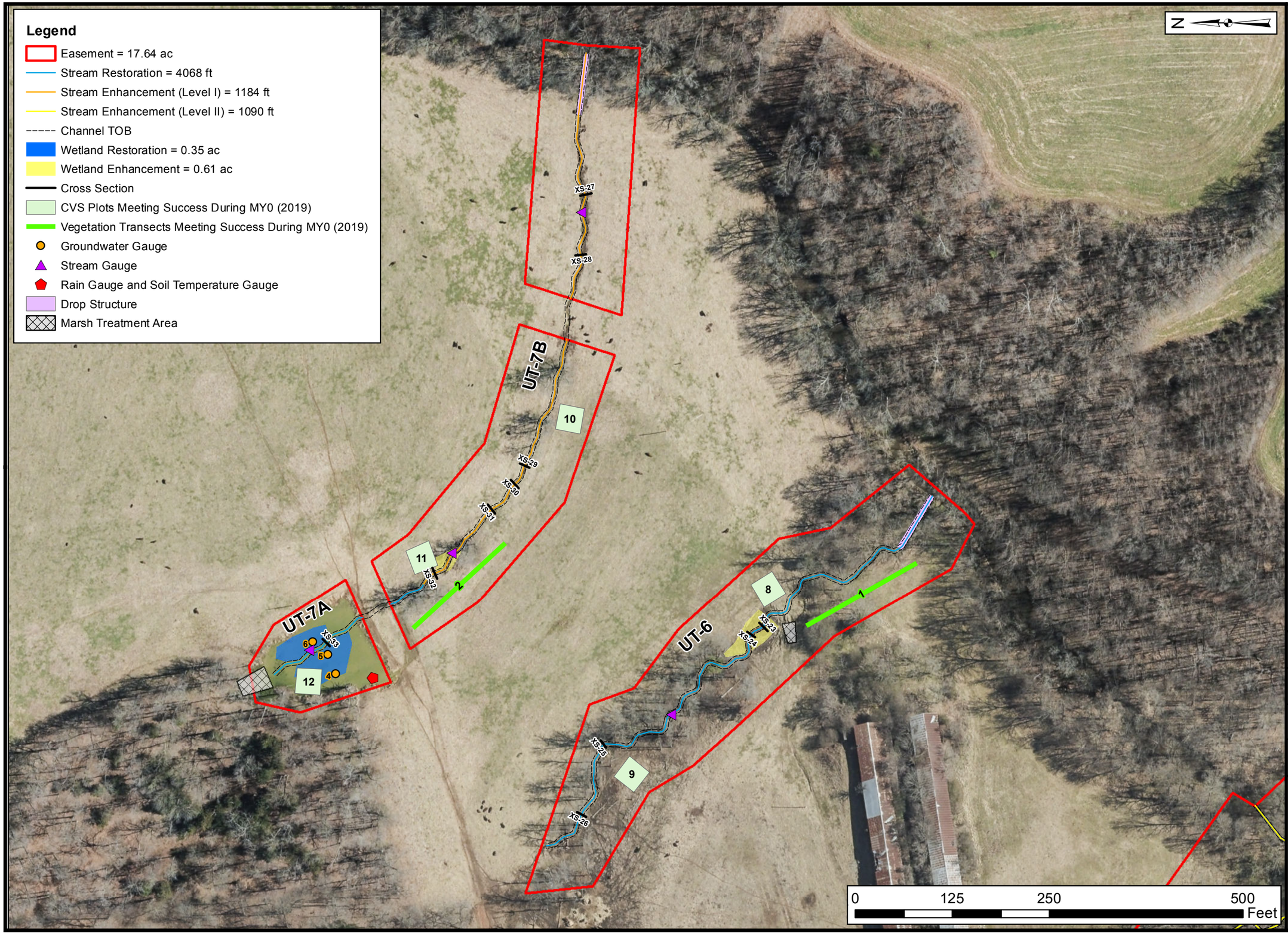
Project No.: 17-008

FIGURE

2B

Legend

- Easement = 17.64 ac
- Stream Restoration = 4068 ft
- Stream Enhancement (Level I) = 1184 ft
- Stream Enhancement (Level II) = 1090 ft
- Channel TOB
- Wetland Restoration = 0.35 ac
- Wetland Enhancement = 0.61 ac
- Cross Section
- CVS Plots Meeting Success During MY0 (2019)
- Vegetation Transects Meeting Success During MY0 (2019)
- Groundwater Gauge
- Stream Gauge
- Rain Gauge and Soil Temperature Gauge
- Drop Structure
- Marsh Treatment Area



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

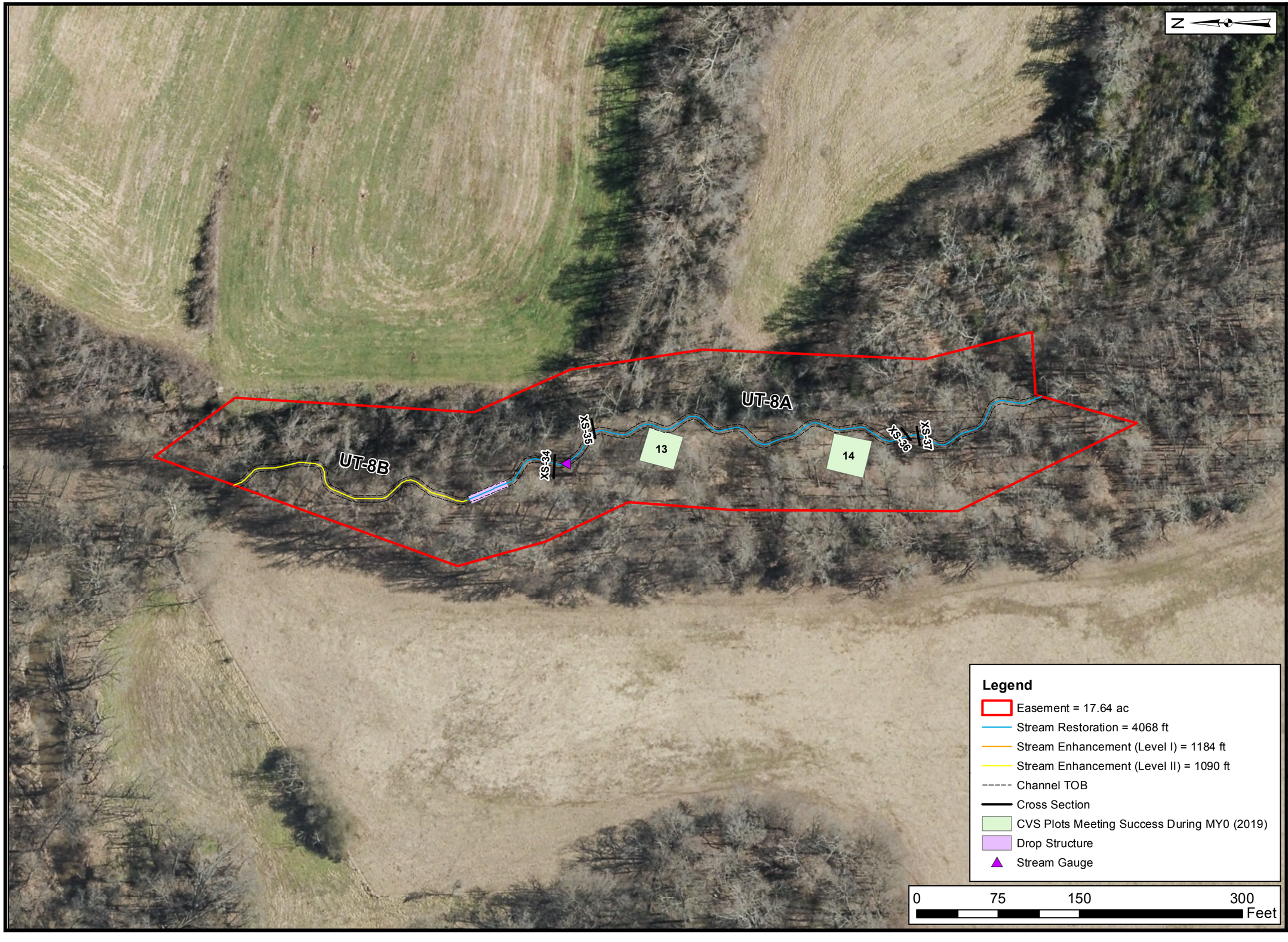
Date: MAY 2019

Scale: 1:1400

Project No.: 17-008

FIGURE

2C



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

HERON STREAM AND WETLAND MITIGATION SITE

Alamance County, NC

Title:

CURRENT CONDITIONS PLAN VIEW

Drawn by: KRJ

Date: MAY 2019

Scale: 1:1000

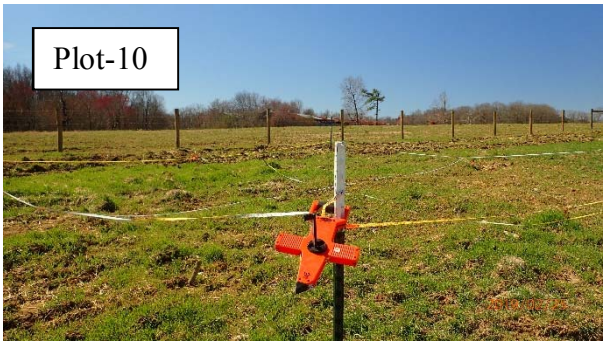
Project No.: 17-008

FIGURE

2D

Heron Asbuilt Vegetation Plots
Photos Taken February 25, 2019

Heron Asbuilt Vegetation Plots
Photos Taken February 25, 2019
(continued)



Appendix C
Vegetation Data

Table 5. Planted Bare Root Woody Vegetation
Table 6. Total Stems by Plot and Species
Table 7. Temporary Vegetation Plot Data
Table 8. Planted Vegetation Totals

Table 5. Planted Bare Root Woody Vegetation
Heron Restoration Site

Species	Total*
Acres	**12.05**
Alnus serrulata	500
Asimina triloba	100
Betula nigra	400
Carpinus caroliniana	800
Cephalanthus occidentalis	25
Cercis canadensis	500
Cornus amomum	2500
Diospyros virginiana	350
Fraxinus americana	100
Fraxinus pennsylvanica	2500
Liriodendron tulipifera	125
Nyssa sylvatia	500
Platanus occidentalis	2400
Quercus lyrate	900
Quercus nigra	2000
Quercus phellos	1900
Sambucus canadensis	25
TOTALS	**15,625***
Average Stems/Acre	**1297**

*Live stakes of *Salix nigra* were planted, but are not included in this table.

Table 6. Total Stems by Plot and Species
EEP Project Code 17.008. Project Name: Heron Stream and Wetland

			Current Plot Data (MY0 2019)																							
			17.008-01-0001			17.008-01-0002			17.008-01-0003			17.008-01-0004			17.008-01-0005			17.008-01-0006			17.008-01-0007			17.008-01-0008		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub	2	2	2																			1	1	1
Asimina triloba	pawpaw	Tree	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
Betula nigra	river birch	Tree																								
Carpinus caroliniana	American hornbeam	Tree	1	1	1	1	1	1				7	7	7												
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cercis canadensis	eastern redbud	Tree				5	5	5													1	1	1	2	2	2
Cornus amomum	silky dogwood	Shrub																						2	2	2
Diospyros virginiana	common persimmon	Tree	7	7	7				1	1	1							1	1	1	4	4	4			
Fraxinus americana	white ash	Tree																								
Fraxinus pennsylvanica	green ash	Tree													1	1	1	5	5	5						
Liriodendron tulipifera	tuliptree	Tree																								
Nyssa sylvatica	blackgum	Tree	1	1	1				1	1	1							1	1	1	2	2	2			
Platanus occidentalis	American sycamore	Tree							1	1	1				4	4	4							1	1	1
Quercus	oak	Tree							8	8	8				2	2	2	1	1	1	6	6	6	4	4	4
Quercus lyrata	overcup oak	Tree										1	1	1	2	2	2									
Quercus nigra	water oak	Tree				5	5	5				1	1	1	1	1	1				1	1	1	1	1	1
Quercus phellos	willow oak	Tree										1	1	1				1	1	1						
Quercus rubra	northern red oak	Tree																			1	1	1			
Sambucus canadensis	Common Elderberry	Shrub																								
Unknown		Shrub or Tree	3	3	3										1	1	1				1	1	1			
		Stem count	16	16	16	13	13	13	12	12	12	11	11	11	12	12	12	10	10	10	17	17	17	13	13	13
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	6	6	6	4	4	4	5	5	5	5	5	5	7	7	7	6	6	6	8	8	8	7	7	7
		Stems per ACRE	647.5	647.5	647.5	526.1	526.1	526.1	485.6	485.6	485.6	445.2	445.2	445.2	485.6	485.6	485.6	404.7	404.7	404.7	688	688	688	526.1	526.1	526.1

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes

P-all = Planting including livestakes

T = All planted and natural recruits including livestakes

T includes natural recruits

Table 6. Total Stems by Plot and Species (continued)
EEP Project Code 17.008. Project Name: Heron Stream and Wetland

			Current Plot Data (MY0 2019)																	Annual Means		
			17.008-01-0009			17.008-01-0010			17.008-01-0011			17.008-01-0012			17.008-01-0013			17.008-01-0014			MY0 (2019)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Alnus serrulata	hazel alder	Shrub							1	1	1										4	4	4
Asimina triloba	pawpaw	Tree	1	1	1	1	1	1	2	2	2	1	1	1	5	5	5				21	21	21
Betula nigra	river birch	Tree				1	1	1							1	1	1				2	2	2
Carpinus caroliniana	American hornbeam	Tree				3	3	3										1	1	1	13	13	13
Cephalanthus occidentalis	common buttonbush	Shrub	1	1	1																1	1	1
Cercis canadensis	eastern redbud	Tree							2	2	2										10	10	10
Cornus amomum	silky dogwood	Shrub							2	2	2	2	2	2							6	6	6
Diospyros virginiana	common persimmon	Tree	2	2	2				1	1	1				1	1	1	2	2	2	19	19	19
Fraxinus americana	white ash	Tree	3	3	3				2	2	2										5	5	5
Fraxinus pennsylvanica	green ash	Tree							3	3	3	6	6	6							15	15	15
Liriodendron tulipifera	tuliptree	Tree				1	1	1										1	1	1	2	2	2
Nyssa sylvatica	blackgum	Tree	1	1	1	1	1	1	1	1	1				2	2	2				10	10	10
Platanus occidentalis	American sycamore	Tree				2	2	2	1	1	1	1	1	1	1	1	1				11	11	11
Quercus	oak	Tree	4	4	4				2	2	2	3	3	3				1	1	1	31	31	31
Quercus lyrata	overcup oak	Tree	1	1	1	1	1	1	2	2	2				1	1	1				8	8	8
Quercus nigra	water oak	Tree	1	1	1	3	3	3							2	2	2	4	4	4	19	19	19
Quercus phellos	willow oak	Tree				4	4	4				1	1	1				4	4	4	11	11	11
Quercus rubra	northern red oak	Tree																			1	1	1
Sambucus canadensis	Common Elderberry	Shrub										2	2	2							2	2	2
Unknown		Shrub or Tree																			5	5	5
		Stem count	14	14	14	17	17	17	19	19	19	16	16	16	13	13	13	13	13	13	196	196	196
		size (ares)	1			1			1			1			1			1			14		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.35		
		Species count	8	8	8	9	9	9	11	11	11	7	7	7	7	7	7	6	6	6	20	20	20
		Stems per ACRE	566.6	566.6	566.6	688	688	688	768.9	768.9	768.9	647.5	647.5	647.5	526.1	526.1	526.1	526.1	526.1	526.1	566.6	566.6	566.6

Color for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

PnoLS = Planted excluding livestakes
P-all = Planting including livestakes
T = All planted and natural recruits including livestakes
T includes natural recruits

Table 7. Temporary Vegetation Plot Data
Heron Restoration Site

Species	50m x 2m Temporary Plot (Bearing)			
	T-1 (120^0)	T-2 (280^0)	T-3 (221^0)	T-4 (347^0)
Asimina triloba	--	3	3	1
Betula nigra	--	--	--	1
Carpinus caroliniana	--	--	--	1
Cercis canadensis	1	--	--	3
Cornus amomum	6	--	2	--
Diospyros virginiana	1	3	--	6
Fraxinus pennsylvanica	1	3	1	1
Liriodendron tulipifera	1	--	--	--
Nyssa sylvatia	--	--	--	1
Platanus occidentalis	2	--	--	--
Quercus lyrata	--	1	3	1
Quercus nigra	2	4	5	1
Quercus phellos	1	5	4	2
Quercus sp.	3	--	2	1
Total Stems	**18**	**19**	**20**	**19**
Total Stems/Acre	**729**	**769**	**810**	**769**

Table 8. Planted Vegetation Totals
Heron Restoration Site

Plot #	Planted Stems/Acre	Success Criteria Met?
1	648	Yes
2	526	Yes
3	486	Yes
4	445	Yes
5	486	Yes
6	405	Yes
7	688	Yes
8	526	Yes
9	567	Yes
10	688	Yes
11	769	Yes
12	648	Yes
13	526	Yes
14	526	Yes
T-1	729	Yes
T-2	769	Yes
T-3	810	Yes
T-4	769	Yes
Average Planted Stems/Acre	**612**	**Yes**

Appendix D
Stream Geomorphology Data

Tables 9A-9G. Baseline Stream Data Summary
Tables 10A-10G. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Tables 11A-11G. Monitoring Data-Dimensional Morphology Summary (Dimensional Parameters-Cross-sections)
Tables 12A-12G. Monitoring Data-Stream Reach Data Summary

Table 9a. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 1 (856 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					4.7	8.5		11.1			8	8.1	12.1	10.7	11	11.3	7.8	8.4	9	8.3	11		13		4
Floodprone Width (ft)					13	20		30			15	18	25	122	131	140	10	75	100	25	100		100		4
Bankfull Mean Depth (ft)					0.5	0.7		1.1			0.8	0.8	1	1.3	1.4	1.4	0.6	0.6	0.7	0.4	0.5		0.6		4
[1]Bankfull Max Depth (ft)					0.8	1.1		2			1.1	1.4	1.4	1.9	2	2	0.7	0.8	1	0.6	0.8		1.1		4
Bankfull Cross Sectional Area (ft^2)						5.1						8			14.7		5.1	5.1	5.1	3.7	5.4		7.2		4
Width/Depth Ratio					4.3	14.6		22			8	10.1	15.1	8	9	9	12	14	16	17.4	18.7		36.7		4
Entrenchment Ratio					1.6	2.5		4.3			1.9	2.1	2.2	11	12	13	5.1	8.9	11.1	3	8.3		9.3		4
[1]Bank Height Ratio					1.4	1.9		2.5			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		4
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															2.7	19	16	53	11	31
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.007	0.009	0.01	0	0.013	0.012	0.048	0.01	31
Pool Length (ft)																				6	23	20	80	12.9	34
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.8	1.1	1.3	1.5	1.6		2.1		4
Pool Spacing (ft)											25	37	69	22	44	81	25	34	68	25	34		68		34
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	25	34	68	25	34		68		
Radius of Curvature (ft)											11	16	27	9	31	113	17	25	85	17	25		85		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	51	72	101	51	72		101		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					0.61												0.19			0.24					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Cg 5						Eb 4			E5			E/C 4			C 4					
Bankfull Velocity (fps)					3.8												3.8			3.6					
Bankfull Discharge (cfs)					19.3																				
Valley length (ft)					1067																				
Channel Thalweg length (ft)					1433												856			856					
Sinuosity (ft)					1.3						1.2			1.46			1.3			1.3					
Water Surface Slope (Channel) (ft/ft)					0.0057						0.0258			0.0053			0.0057			0.0087					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					61						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9b. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 3 (279 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)					3.2	4.5		5.9			8	8.1	12.1	10.7	11	11.3	4.1	4.4	4.7	7.7	7.7		7.7		1
Floodprone Width (ft)					9	14		21			15	18	25	122	131	140	20	40	60	18	18		18		1
Bankfull Mean Depth (ft)					0.2	0.3		0.4			0.8	0.8	1	1.3	1.4	1.4	0.3	0.3	0.3	0.6	0.6		0.6		1
[1]Bankfull Max Depth (ft)					0.5	0.6		0.7			1.1	1.4	1.4	1.9	2	2	0.4	0.4	0.5	1	1		1		1
Bankfull Cross Sectional Area (ft^2)						1.4						8			14.7		1.4	1.4	1.4	4.5	4.5		4.5		1
Width/Depth Ratio					8	17.4		29.5			8	10.1	15.1	8	9	9	12	14	16	13.2	13.2		13.2		1
Entrenchment Ratio					1.4	2.2		3.8			1.9	2.1	2.2	11	12	13	4.9	9	12.7	2.3	2.3		2.3		1
[1]Bank Height Ratio					1.7	2.2		2.4			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		1
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															4	11	10	19	4.3	14
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.023	0.031	0.035	0.011	0.029	0.027	0.736	0.017	14
Pool Length (ft)																				4	9	8	21	4.9	13
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.4	0.6	0.7	1	1	1	1	0	1
Pool Spacing (ft)											25	37	69	22	44	81	13	18	35	13	18		35		14
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	13	18	27	13	18		27		
Radius of Curvature (ft)											11	16	27	9	31	113	9	13	44	9	13		44		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	26	37	53	26	37		53		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					1.42												0.34			0.56					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Cg 5						Eb 4			E5			E/C 4			C 4					
Bankfull Velocity (fps)					3.6												3.6			1.1					
Bankfull Discharge (cfs)					5																				
Valley length (ft)					229																				
Channel Thalweg length (ft)					247												279			279					
Sinuosity (ft)					1.07						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0207						0.0258			0.0053			0.0193			0.0176					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					100						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9c. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 4 (450 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					3.1	3.8		4.9			8	8.1	12.1	10.7	11	11.3	4.6	5	5.4	6.5	7.3		8		2
Floodprone Width (ft)					6	15		30			15	18	25	122	131	140	25	50	75	40	40		40		2
Bankfull Mean Depth (ft)					0.4	0.5		0.6			0.8	0.8	1	1.3	1.4	1.4	0.3	0.4	0.4	0.3	0.4		0.5		2
[1]Bankfull Max Depth (ft)					0.7	0.8		0.9			1.1	1.4	1.4	1.9	2	2	0.4	0.5	0.6	0.5	0.7		0.8		2
Bankfull Cross Sectional Area (ft^2)						2						8			14.7		1.8	1.8	1.8	2.2	3		3.7		2
Width/Depth Ratio					5.2	7.7		12.3			8	10.1	15.1	8	9	9	12	14	16	17.3	18.3		19.2		2
Entrenchment Ratio					1.3	3.9		6.1			1.9	2.1	2.2	11	12	13	5.4	10	14	5	5.6		6.2		2
[1]Bank Height Ratio					1.3	2.3		4.0			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		2
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															4	9	9	20	3.5	23
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.037	0.05	0.056	0	0.021	0.017	0.061	0.014	23
Pool Length (ft)																				4	10	10	18	3.5	22
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.5	0.7	0.8	1.1	1.3		1.4		2
Pool Spacing (ft)											25	37	69	22	44	81	15	20	40	15	20		40		22
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	15	20	30	15	20		30		
Radius of Curvature (ft)											11	16	27	9	31	113	10	15	50	10	15		50		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	30	43	60	30	43		60		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					2.79												0.6			0.59					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Eg 5						Eb 4			E5			E/C 4			C 4					
Bankfull Velocity (fps)					3.7												4			2.4					
Bankfull Discharge (cfs)					7.3																				
Valley length (ft)					391																				
Channel Thalweg length (ft)					428												450			450					
Sinuosity (ft)					1.09						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0283						0.0258			0.0053			0.3111			0.0254					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					56						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9d. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 5 (952 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					2.5	3.7		6			8	8.1	12.1	10.7	11	11.3	4.6	5	5.4	4.9	6.9		8.1		4
Floodprone Width (ft)					4	12		30			15	18	25	122	131	140	25	50	75	40	40		40		4
Bankfull Mean Depth (ft)					0.3	0.5		0.6			0.8	0.8	1	1.3	1.4	1.4	0.3	0.4	0.4	0.3	0.4		0.5		4
[1]Bankfull Max Depth (ft)					0.5	0.8		0.9			1.1	1.4	1.4	1.9	2	2	0.4	0.5	0.6	0.5	0.7		0.8		4
Bankfull Cross Sectional Area (ft^2)						1.6						8			14.7		1.8	1.8	1.8	1.9	2.4		3.7		4
Width/Depth Ratio					3.6	8.8		20			8	10.1	15.1	8	9	9	12	14	16	12.6	18.3		20.9		4
Entrenchment Ratio					1.4	3.1		7.3			1.9	2.1	2.2	11	12	13	5.4	10	14	4.9	5.9		8.2		4
[1]Bank Height Ratio					1.3	1.5		2.0			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		4
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															3	11	9	49	8.4	41
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.037	0.05	0.056	0.004	0.028	0.027	0.051	0.01	41
Pool Length (ft)																				4	12	10	59	8.5	41
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.5	0.7	0.8	0.8	1		1.1		4
Pool Spacing (ft)											25	37	69	22	44	81	15	20	40	15	20		40		41
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	15	20	30	15	20		30		
Radius of Curvature (ft)											11	16	27	9	31	113	10	15	50	10	15		50		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	30	43	60	30	43		60		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					2.79												0.6			0.5					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Eg 5						Eb 4			E5			E/C 4			E/C 4					
Bankfull Velocity (fps)					3.9												4			2.3					
Bankfull Discharge (cfs)					5.5																				
Valley length (ft)					579																				
Channel Thalweg length (ft)					605												952			952					
Sinuosity (ft)					1.04						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0372						0.0258			0.0053			0.3111			0.0256					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					50						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9e. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 6 (781 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					4.6	6.4		9.6			8	8.1	12.1	10.7	11	11.3	4.2	4.6	4.9	6.1	6.5		6.8		2
Floodprone Width (ft)					7	16		46			15	18	25	122	131	140	25	50	75	40	40		40		2
Bankfull Mean Depth (ft)					0.2	0.3		0.3			0.8	0.8	1	1.3	1.4	1.4	0.3	0.3	0.4	0.4	0.4		0.5		2
[1]Bankfull Max Depth (ft)					0.4	0.5		0.8			1.1	1.4	1.4	1.9	2	2	0.4	0.5	0.5	0.6	0.8		0.9		2
Bankfull Cross Sectional Area (ft^2)						1.5						8			14.7		1.5	1.5	1.5	2.2	2.9		3.5		2
Width/Depth Ratio					15.3	26.7		48			8	10.1	15.1	8	9	9	12	14	16	13.2	15.1		16.9		2
Entrenchment Ratio					1.1	2.4		4.8			1.9	2.1	2.2	11	12	13	5.9	10.9	15.3	5.9	6.2		6.6		2
[1]Bank Height Ratio					3.7	5.0		7.5			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		2
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															2	10	7	47	8.8	33
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.031	0.042	0.047	0.001	0.028	0.024	0.126	0.021	33
Pool Length (ft)																				4	12	12	18	3.7	33
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.4	0.6	0.7	1	1.2		1.3		2
Pool Spacing (ft)											25	37	69	22	44	81	13.7	18.3	36.7	14	18		37		33
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	13.7	18.3	36.7	14	18		37		
Radius of Curvature (ft)											11	16	27	9	31	113	9	14	46	9	14		46		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	27	39	55	27	39		55		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/ft^2					14.18												0.47			0.56					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Cg 5						Eb 4			E5			E/C 4			C 4					
Bankfull Velocity (fps)					3.5												3.5			1.8					
Bankfull Discharge (cfs)					5.2																				
Valley length (ft)					486																				
Channel Thalweg length (ft)					522												781			781					
Sinuosity (ft)					1.07						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.028						0.0258			0.0053			0.0261			0.0225					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					68						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9f. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 7 (232 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)					4.1	5.3		6.7			8	8.1	12.1	10.7	11	11.3	4.9	5.3	5.7	6.2	6.6		7.8		4
Floodprone Width (ft)					7	13		29			15	18	25	122	131	140	25	50	75	10	20		20		4
Bankfull Mean Depth (ft)					0.3	0.4		0.5			0.8	0.8	1	1.3	1.4	1.4	0.4	0.4	0.4	0.3	0.4		0.5		4
[1]Bankfull Max Depth (ft)					0.4	0.6		0.8			1.1	1.4	1.4	1.9	2	2	0.5	0.5	0.6	0.5	0.6		0.7		4
Bankfull Cross Sectional Area (ft^2)						2						8			14.7		2	2	2	1.8	2.7		3.3		4
Width/Depth Ratio					8.2	14.5		22.3			8	10.1	15.1	8	9	9	12	14	16	12.8	18.5		24.2		4
Entrenchment Ratio					1.7	2.4		5.2			1.9	2.1	2.2	11	12	13	5	9	13	1.6	2.8		3.1		4
[1]Bank Height Ratio					1.8	2.5		4.1			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		4
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															3	13	10	75	13	42
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.027	0.036	0.04	0.006	0.029	0.029	0.056	0.011	42
Pool Length (ft)																				3	9	9	14	2.6	41
Pool Max depth (ft)											1.5	1.8	2.1		2.7		1.3	1.9	2.1	1	1.1		1.5		3
Pool Spacing (ft)											25	37	69	22	44	81	16	21	42	16	21		42		42
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	16	21	32	16	21		32		
Radius of Curvature (ft)											11	16	27	9	31	113	10	16	53	10	16		53		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	31	45	64	31	45		64		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					2.36												0.45			0.61					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Cg 5						Eb 4			E5			Eb 4			Cb 4					
Bankfull Velocity (fps)					3.5												3.5			2.6					
Bankfull Discharge (cfs)					7																				
Valley length (ft)					755																				
Channel Thalweg length (ft)					778												232			232					
Sinuosity (ft)					1.03						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0248						0.0258			0.0053			0.0222			0.0268					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					76						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 9g. Baseline Stream Data Summary

Project Name/Number (Heron/100014) - Segment/Reach: UT 8 (605 feet)

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Cedarock Park Ref			Causey Ref			Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Max	Min	Mean	Max	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)					4.2	5.1		6.1			8	8.1	12.1	10.7	11	11.3	5.5	5.9	6.3	6.5	7.9		9.3		2
Floodprone Width (ft)					5	15		30			15	18	25	122	131	140	25	50	75	20	30		40		2
Bankfull Mean Depth (ft)					0.4	0.5		0.6			0.8	0.8	1	1.3	1.4	1.4	0.4	0.4	0.5	0.4	0.4		0.4		2
[1]Bankfull Max Depth (ft)					0.6	0.8		1			1.1	1.4	1.4	1.9	2	2	0.5	0.6	0.7	0.7	0.7		0.7		2
Bankfull Cross Sectional Area (ft^2)						2.5						8			14.7		2.5	2.5	2.5	2.6	3.2		3.7		2
Width/Depth Ratio					7	11.3		15.3			8	10.1	15.1	8	9	9	12	14	16	16.3	19.8		23.4		2
Entrenchment Ratio					1.1	2.7		4.9			1.9	2.1	2.2	11	12	13	4.6	8.5	11.9	2.2	4.2		6.2		2
[1]Bank Height Ratio					1.4	2.3		3.7			1.0	1.8			1.4		1.0	1.0	1.3	1.0	1.0		1.0		2
Profile																									
Riffle Length (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.															5	11	11	19	3.4	23
Riffle Slope (ft/ft)											0.01	0.0316	0.0576	0.002	0.01	0.012	0.023	0.03	0.034	0.007	0.02	0.017	0.041	0.009	23
Pool Length (ft)																				6	15	15	24	4.8	23
Pool Max depth (ft)											1.5	1.8	2.1		2.7		0.5	0.8	0.9	0.9	1.3		1.6		2
Pool Spacing (ft)											25	37	69	22	44	81	17	24	47	17	24		47		23
Pattern																									
Channel Beltwidth (ft)					No distinct repetitive pattern of riffles and pools due to straightening activities.						20	23	38	17	30	36	17	24	36	17	24		36		
Radius of Curvature (ft)											11	16	27	9	31	113	11	18	59	11	18		59		
Rc:Bankfull width (ft/ft)											1.4	2	3.3	0.8	2.8	10.3	2	3	10	2	3		10		
Meander Wavelength (ft)											44	68	116	10	63	91	35	50	71	35	50		71		
Meander Width Ratio											2.4	2.8	4.7	1.5	2.7	3.5	3	4	6	3	4		6		
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					1.85												0.44			0.32					
Max part size (mm) mobilized at bankfull																									
Stream Power (transport capacity) W/m^2																									
Additional Reach Parameters																									
Rosgen Classification					Eg 5						Eb 4			E5			E/C 4			C 4					
Bankfull Velocity (fps)					3.6												3.6			2.8					
Bankfull Discharge (cfs)					9.1																				
Valley length (ft)					520																				
Channel Thalweg length (ft)					543												605			605					
Sinuosity (ft)					1.04						1.2			1.46			1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					0.0218						0.0258			0.0053			0.019			0.0138					
BF slope (ft/ft)																									
[3]Bankfull Floodplain Area (acres)																									
[4]% of Reach with Eroding Banks					80						0			0											
Channel Stability or Habitat Metric																									
Biological or Other																									

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10a. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 1 (856 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						60	13	14	13				43	19	19	19			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10		29	71						33			66						50	50												25	75			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0		14	43	43				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 3 (279 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						74	8	9	8				55	15	15	15			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	33	33	33						33			66						50	50												100					
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0			33	66				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10c. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 4 (450 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						63	12	13	12				48	17	18	17			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10		25	25	50					33			66						50	50													100			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0		25	25	50				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10d. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 5 (952 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						58	14	14	14				50	17	17	16			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	20	20	40	20					33			66						50	50														100			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0		20	20	60				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10e. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 6 (781 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						64	12	12	12				46	18	18	18			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	40	20	20	20					33			66						50	50														100			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0				100				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10f. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 7 (232 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						76	7	8	7				60	13	14	13			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10		57	29	14					33			66						50	50											25	75				
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0			29	71				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.
1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates
3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.
The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.
ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtction distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 10g. Baseline Stream Data Summary (Substrate, Bed, Bank, and Hydrologic Containment Parameter Distributions)
Project Name/Number (Heron/100014) - Segment/Reach: UT 8 (605 feet)

Parameter	Pre-Existing Condition							Cedarock Reference Reach Data							Causey Reference Reach Data							Design							As-built/Baseline						
[1]Ri% / Ru% / P% / G% / S%																						60	13	14	13				41	20	20	19			
[1]SC% / Sa% / G% / C% / B% / Be%								9	22	39	18	11			4	54	28	11	1	2															
[1]d16 / d35 / d50 / d84 / d95 / di^{p} / di^{sp} (mm)								0.12	4.1	9.8	161	2568			0.32	0.5	0.9	24	116																
[2]Entrenchment Class <1.5 / 1.5-1.99 / 2.0-4.9 / 5.0-9.9 / >10	25	25	50						33			66						50	50													50	50			
[3]Incision Class <1.2 / 1.2-1.49 / 1.5-1.99 / >2.0		50		50				66		33						100													100						

Shaded cells indicate that these will typically not be filled in.

1 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave

2 = Entrenchment Class - Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as visual estimates

3 = Assign/bin the reach footage into the classes indicated and provide the percentage of the total reach footage in each class in the table. This will result from the measured cross-sections as well as the longitudinal profile

Footnotes 2,3 - These classes are loosley built around the Rosgen classification and hazard ranking breaks, but were adjusted slightly to make for easier assignment to somewhat coarser bins based on visual estimates in the field such that measurement of every segment for ER would not be necessary.

The intent here is to provide the reader/consumer of design and monitoring information with a good general sense of the extent of hydrologic containment in the pre-existing and the rehabilitated states as well as comparisons to the reference distributions.

ER and BHR have been addressed in prior submissions as a subsample (cross-sections as part of the design measurements), however, these subsamples have often focused entirely on facilitating design without providing a thorough pre-construtions distribution of these parameters, leaving the reader/consumer with a sample that is weighted heavily on the stable sections of the reach. This means that the distributions for these parameters should include data from both the cross-section measurements and the longitudinal profile and in the case of ER, visual estimates. For example, the typical longitudinal profile permits sampling of the BHR at riffles beyond those subject to cross-sections and therefore can be readily integrated and provide a more complete sample distribution for these parameters, thereby providing the distribution/coverage necessary to provide meaningful comparisons.

Table 11a. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 1 (856 feet)

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																																			
Bankfull Width (ft)	9.2							10.7							13.0							8.9							8.3						
Floodprone Width (ft)	NA							100							100							NA							25						
Bankfull Mean Depth (ft)	1.1							0.6							0.4							0.8							0.4						
Bankfull Max Depth (ft)	2.1							0.9							0.7							1.6							0.6						
Bankfull Cross Sectional Area (ft^2)	10.5							6.1							4.6							6.8							3.7						
Bankfull Width/Depth Ratio	NA							18.8							36.7							NA							18.6						
Bankfull Entrenchment Ratio	NA							9.3							7.7							NA							3.0						
Low Bank Height (ft)	2.1							0.9							0.7							1.6							0.6						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

	Cross Section 6 (Pool)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)																								
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+															
Record elevation (datum) used																																			
Bankfull Width (ft)	12.8							9.6							11.2																					
Floodprone Width (ft)	NA							NA							100																					
Bankfull Mean Depth (ft)	0.7							0.8							0.6																					
Bankfull Max Depth (ft)	1.6							1.5							1.1																					
Bankfull Cross Sectional Area (ft^2)	9.4							8.0							7.2																					
Bankfull Width/Depth Ratio	NA							NA							17.4																					
Bankfull Entrenchment Ratio	NA							NA							8.9																					
Low Bank Height (ft)	1.6							1.5							1.1																					
Bankfull Bank Height Ratio	1.0							1.0							1.0																					
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11b. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 3 (279 feet)

	Cross Section 9 (Pool)							Cross Section 10 (Riffle)																												
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+																						
Record elevation (datum) used																																			
Bankfull Width (ft)	4.2							7.7																												
Floodprone Width (ft)	NA							18																												
Bankfull Mean Depth (ft)	0.7							0.6																												
Bankfull Max Depth (ft)	1.0							1.0																												
Bankfull Cross Sectional Area (ft^2)	2.9							4.5																												
Bankfull Width/Depth Ratio	NA							13.2																												
Bankfull Entrenchment Ratio	NA							2.3																												
Low Bank Height (ft)	1.0							1.0																												
Bankfull Bank Height Ratio	1.00							1.00																												
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				
Based on fixed baseline bankfull elevation[1]																																				
Record elevation (datum) used																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft^2)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Low Bank Height (ft)																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11c. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 4 (450 feet)

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Riffle)							Cross Section 14 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	6.0							6.5							8.0							9.1						
Floodprone Width (ft)	NA							40							40							NA						
Bankfull Mean Depth (ft)	0.8							0.3							0.5							0.7						
Bankfull Max Depth (ft)	1.1							0.5							0.8							1.4						
Bankfull Cross Sectional Area (ft^2)	4.8							2.2							3.7							6.8						
Bankfull Width/Depth Ratio	NA							19.2							17.3							NA						
Bankfull Entrenchment Ratio	NA							6.2							5.0							NA						
Low Bank Height (ft)	1.1							0.5							0.8							1.4						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												
Based on fixed baseline bankfull elevation[1]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Low Bank Height (ft)																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11d. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 5 (952 feet)

	Cross Section 15 (Pool)							Cross Section 16 (Riffle)							Cross Section 17 (Pool)							Cross Section 18 (Riffle)							Cross Section 19 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																																				
Bankfull Width (ft)	4.7							6.3							5.4							8.1							7.8						
Floodprone Width (ft)	NA							40							NA							40							NA						
Bankfull Mean Depth (ft)	0.5							0.3							0.6							0.5							0.4						
Bankfull Max Depth (ft)	0.8							0.5							1.1							0.8							0.9						
Bankfull Cross Sectional Area (ft^2)	2.4							1.9							3.4							3.7							3.3						
Bankfull Width/Depth Ratio	NA							20.9							NA							17.7							NA						
Bankfull Entrenchment Ratio	NA							6.3							NA							4.9							NA						
Low Bank Height (ft)	0.8							0.5							1.1							0.8							0.9						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				
	Cross Section 20 (Riffle)							Cross Section 21 (Pool)							Cross Section 22 (Riffle)																							
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+															
Record elevation (datum) used																																				
Bankfull Width (ft)	4.9							5.0							7.4																					
Floodprone Width (ft)	40							NA							40																					
Bankfull Mean Depth (ft)	0.4							0.6							0.4																					
Bankfull Max Depth (ft)	0.6							1.1							0.7																					
Bankfull Cross Sectional Area (ft^2)	1.9							3.1							2.9																					
Bankfull Width/Depth Ratio	12.6							NA							18.9																					
Bankfull Entrenchment Ratio	8.2							NA							5.4																					
Low Bank Height (ft)	0.6							1.1							0.7																					
Bankfull Bank Height Ratio	1.00							1.0							1.0																					
Cross Sectional Area between end pins (ft^2)																																				
d50 (mm)																																				

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11e. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 6 (781 feet)

	Cross Section 23 (Pool)							Cross Section 24 (Riffle)							Cross Section 25 (Pool)							Cross Section 26 (Riffle)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	5.6							6.1							5.2							6.8						
Floodprone Width (ft)	NA							40							NA							40						
Bankfull Mean Depth (ft)	0.6							0.4							0.6							0.5						
Bankfull Max Depth (ft)	1.0							0.6							1.3							0.9						
Bankfull Cross Sectional Area (ft^2)	3.6							2.2							3.2							3.5						
Bankfull Width/Depth Ratio	NA							16.9							NA							13.2						
Bankfull Entrenchment Ratio	NA							6.6							NA							5.9						
Low Bank Height (ft)	1.0							0.6							1.3							0.9						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												
Based on fixed baseline bankfull elevation[1]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Low Bank Height (ft)																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11f. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 7 (232 feet)

	Cross Section 27 (Pool)							Cross Section 28 (Riffle)							Cross Section 29 (Pool)							Cross Section 30 (Riffle)							Cross Section 31 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																																			
Bankfull Width (ft)	7.1							7.8							4.1							6.2							5.3						
Floodprone Width (ft)	NA							20							NA							10							NA						
Bankfull Mean Depth (ft)	0.9							0.4							0.8							0.4							0.6						
Bankfull Max Depth (ft)	1.5							0.6							1.1							0.5							1.0						
Bankfull Cross Sectional Area (ft^2)	6.3							3.0							3.4							2.3							3.0						
Bankfull Width/Depth Ratio	NA							20.3							NA							16.7							NA						
Bankfull Entrenchment Ratio	NA							2.6							NA							1.6							NA						
Low Bank Height (ft)	1.5							0.6							1.1							0.5							1.0						
Bankfull Bank Height Ratio	1.00							1.00							1.00							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			
	Cross Section 32 (Riffle)							Cross Section 33 (Riffle)																													
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+																					
Record elevation (datum) used																																			
Bankfull Width (ft)	6.5							6.6																											
Floodprone Width (ft)	20							20																											
Bankfull Mean Depth (ft)	0.5							0.3																											
Bankfull Max Depth (ft)	0.7							0.5																											
Bankfull Cross Sectional Area (ft^2)	3.3							1.8																											
Bankfull Width/Depth Ratio	12.8							24.2																											
Bankfull Entrenchment Ratio	3.1							3.0																											
Low Bank Height (ft)	0.7							0.5																											
Bankfull Bank Height Ratio	1.00							1.00																											
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Table 11g. Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)
Project Name/Number (Heron/100014) Segment/Reach: UT 8 (605 feet)

	Cross Section 34 (Riffle)							Cross Section 35 (Pool)							Cross Section 36 (Riffle)							Cross Section 37 (Pool)						
Based on fixed baseline bankfull elevation[1]	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Record elevation (datum) used																												
Bankfull Width (ft)	6.5							7.5							9.3							9.5						
Floodprone Width (ft)	40							NA							20							NA						
Bankfull Mean Depth (ft)	0.4							0.5							0.4							0.8						
Bankfull Max Depth (ft)	0.7							0.9							0.7							1.6						
Bankfull Cross Sectional Area (ft^2)	2.6							4.1							3.7							7.2						
Bankfull Width/Depth Ratio	16.3							NA							23.4							NA						
Bankfull Entrenchment Ratio	6.2							NA							2.2							NA						
Low Bank Height (ft)	0.7							0.9							0.7							1.6						
Bankfull Bank Height Ratio	1.0							1.0							1.00							1.00						
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												
Based on fixed baseline bankfull elevation[1]																												
Record elevation (datum) used																												
Bankfull Width (ft)																												
Floodprone Width (ft)																												
Bankfull Mean Depth (ft)																												
Bankfull Max Depth (ft)																												
Bankfull Cross Sectional Area (ft^2)																												
Bankfull Width/Depth Ratio																												
Bankfull Entrenchment Ratio																												
Low Bank Height (ft)																												
Bankfull Bank Height Ratio																												
Cross Sectional Area between end pins (ft^2)																												
d50 (mm)																												

1 = Widths and depths for annual measurements will be based on the baseline bankfull datum regardless of dimensional/depositional development. Input the elevation used as the datum, which should be consistent and based on the baseline datum established. If the performer has inherited the project and cannot acquire the datum used for prior years this must be discussed with EEP. If this cannot be resolved in time for a given years report submission a footnote in this should be included that states: "It is uncertain if the monitoring datum has been consistent over the monitoring history, which may influence calculated values. Additional data from a prior performer is being acquired to provide confirmation. Values will be recalculated in a future submission based on a consistent datum if determined to be necessary."

Exhibit Table 12a. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 1 (856 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	8.3	11		13		4																														
Floodprone Width (ft)	25	100		100		4																														
Bankfull Mean Depth (ft)	0.4	0.5		0.6		4																														
[1]Bankfull Max Depth (ft)	0.6	0.8		1.1		4																														
Bankfull Cross Sectional Area (ft^2)	3.7	5.4		7.2		4																														
Width/Depth Ratio	17.4	18.7		36.7		4																														
Entrenchment Ratio	3	8.3		9.3		4																														
Low Bank Height (ft)	0.6	0.8		1.1		4																														
[1]Bank Height Ratio	1.0	1.0		1.0		4																														
Profile																																				
Riffle Length (ft)	2.7	19	16	53	11	31																														
Riffle Slope (ft/ft)	0	0.013	0.012	0.048	0.01	31																														
Pool Length (ft)	6	23	20	80	12.9	34																														
Pool Max depth (ft)	1.5	1.6		2.1		4																														
Pool Spacing (ft)	25	34		68		34																														
Pattern																																				
Channel Beltwidth (ft)	25	34		68																																
Radius of Curvature (ft)	17	25		85																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	51	72		101																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	C 4																																			
Channel Thalweg length (ft)	856																																			
Sinuosity (ft)	1.3																																			
Water Surface Slope (Channel) (ft/ft)	0.0087																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	43	19	19	19																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	0																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12b. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 3 (279 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	7.7	7.7		7.7		1																														
Floodprone Width (ft)	18	18		18		1																														
Bankfull Mean Depth (ft)	0.6	0.6		0.6		1																														
[1]Bankfull Max Depth (ft)	1	1		1		1																														
Bankfull Cross Sectional Area (ft[2])	4.5	4.5		4.5		1																														
Width/Depth Ratio	13.2	13.2		13.2		1																														
Entrenchment Ratio	2.3	2.3		2.3		1																														
Low Bank Height (ft)	1	1		1		1																														
[1]Bank Height Ratio	1.0	1.0		1.0		1																														
Profile																																				
Riffle Length (ft)	4	11	10	19	4.3	14																														
Riffle Slope (ft/ft)	0.011	0.029	0.027	0.736	0.017	14																														
Pool Length (ft)	4	9	8	21	4.9	13																														
Pool Max depth (ft)	1	1	1	1	0	1																														
Pool Spacing (ft)	13	18		35		14																														
Pattern																																				
Channel Beltwidth (ft)	13	18		27																																
Radius of Curvature (ft)	9	13		44																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	26	37		53																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	C 4																																			
Channel Thalweg length (ft)	279																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0176																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	55	15	15	15																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12c. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 4 (450 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	6.5	7.3		8		2																														
Floodprone Width (ft)	40	40		40		2																														
Bankfull Mean Depth (ft)	0.3	0.4		0.5		2																														
[1]Bankfull Max Depth (ft)	0.5	0.7		0.8		2																														
Bankfull Cross Sectional Area (ft^2)	2.2	3		3.7		2																														
Width/Depth Ratio	17.3	18.3		19.2		2																														
Entrenchment Ratio	5	5.6		6.2		2																														
Low Bank Height (ft)	0.5	0.7		0.8		2																														
[1]Bank Height Ratio	1.0	1.0		1.0		2																														
Profile																																				
Riffle Length (ft)	4	9	9	20	3.5	23																														
Riffle Slope (ft/ft)	0	0.021	0.017	0.061	0.014	23																														
Pool Length (ft)	4	10	10	18	3.5	22																														
Pool Max depth (ft)	1.1	1.3		1.4		2																														
Pool Spacing (ft)	15	20		40		22																														
Pattern																																				
Channel Beltwidth (ft)	15	20		30																																
Radius of Curvature (ft)	10	15		50																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	30	43		60																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	C 4																																			
Channel Thalweg length (ft)	450																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0195																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	48	17	18	17																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12d. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 5 (952 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	4.9	6.9		8.1		4																														
Floodprone Width (ft)	40	40		40		4																														
Bankfull Mean Depth (ft)	0.3	0.4		0.5		4																														
[1]Bankfull Max Depth (ft)	0.5	0.7		0.8		4																														
Bankfull Cross Sectional Area (ft^2)	1.9	2.4		3.7		4																														
Width/Depth Ratio	12.6	18.3		20.9		4																														
Entrenchment Ratio	4.9	5.9		8.2		4																														
Low Bank Height (ft)	0.5	0.7		0.8		4																														
[1]Bank Height Ratio	1.0	1.0		1.0		4																														
Profile																																				
Riffle Length (ft)	3	11	9	49	8.4	41																														
Riffle Slope (ft/ft)	0.004	0.028	0.027	0.051	0.01	41																														
Pool Length (ft)	4	12	10	59	8.5	41																														
Pool Max depth (ft)	0.8	1		1.1		4																														
Pool Spacing (ft)	15	20		40		41																														
Pattern																																				
Channel Beltwidth (ft)	15	20		30																																
Radius of Curvature (ft)	10	15		50																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	30	43		60																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	E/C 4																																			
Channel Thalweg length (ft)	952																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0256																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	50	17	17	16																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12e. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 6 (781 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	6.1	6.5		6.8		2																														
Floodprone Width (ft)	40	40		40		2																														
Bankfull Mean Depth (ft)	0.4	0.4		0.5		2																														
[1]Bankfull Max Depth (ft)	0.6	0.8		0.9		2																														
Bankfull Cross Sectional Area (ft^2)	2.2	2.9		3.5		2																														
Width/Depth Ratio	13.2	15.1		16.9		2																														
Entrenchment Ratio	5.9	6.2		6.6		2																														
Low Bank Height (ft)	0.6	0.8		0.9		2																														
[1]Bank Height Ratio	1.0	1.0		1.0		2																														
Profile																																				
Riffle Length (ft)	2	10	7	47	8.8	33																														
Riffle Slope (ft/ft)	0.001	0.028	0.024	0.126	0.021	33																														
Pool Length (ft)	4	12	12	18	3.7	33																														
Pool Max depth (ft)	1	1.2		1.3		2																														
Pool Spacing (ft)	14	18		37		33																														
Pattern																																				
Channel Beltwidth (ft)	14	18		37																																
Radius of Curvature (ft)	9	14		46																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	27	39		55																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	C 4																																			
Channel Thalweg length (ft)	781																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0225																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	46	18	18	18																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12f. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 7 (232 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	6.2	6.6		7.8		4																														
Floodprone Width (ft)	10	20		20		4																														
Bankfull Mean Depth (ft)	0.3	0.4		0.5		4																														
[1]Bankfull Max Depth (ft)	0.5	0.6		0.7		4																														
Bankfull Cross Sectional Area (ft[2])	1.8	2.7		3.3		4																														
Width/Depth Ratio	12.8	18.5		24.2		4																														
Entrenchment Ratio	1.6	2.8		3.1		4																														
Low Bank Height (ft)	0.5	0.6		0.7		4																														
[1]Bank Height Ratio	1.0	1.0		1.0		4																														
Profile																																				
Riffle Length (ft)	3	13	10	75	13	42																														
Riffle Slope (ft/ft)	0.006	0.029	0.029	0.056	0.011	42																														
Pool Length (ft)	3	9	9	14	2.6	41																														
Pool Max depth (ft)	1	1.1		1.5		3																														
Pool Spacing (ft)	16	21		42		42																														
Pattern																																				
Channel Beltwidth (ft)	16	21		32																																
Radius of Curvature (ft)	10	16		53																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	31	45		64																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	Cb 4																																			
Channel Thalweg length (ft)	232																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0268																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	60	13	14	13																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Exhibit Table 12g. Monitoring Data - Stream Reach Data Summary
Project Name/Number (Heron/100014) - Segment/Reach: UT 8 (605 feet)

Parameter	Baseline						MY-1						MY-2						MY- 3						MY- 4						MY- 5					
Dimension and Substrate - Riffle only	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n	Min	Mean	Med	Max	SD[4]	n
Bankfull Width (ft)	6.5	7.9		9.3		2																														
Floodprone Width (ft)	20	30		40		2																														
Bankfull Mean Depth (ft)	0.4	0.4		0.4		2																														
[1]Bankfull Max Depth (ft)	0.7	0.7		0.7		2																														
Bankfull Cross Sectional Area (ft^2)	2.6	3.2		3.7		2																														
Width/Depth Ratio	16.3	19.8		23.4		2																														
Entrenchment Ratio	2.2	4.2		6.2		2																														
Low Bank Height (ft)	0.7	0.7		0.7		2																														
[1]Bank Height Ratio	1.0	1.0		1.0		2																														
Profile																																				
Riffle Length (ft)	5	11	11	19	3.4	23																														
Riffle Slope (ft/ft)	0.007	0.02	0.017	0.041	0.009	23																														
Pool Length (ft)	6	15	15	24	4.8	23																														
Pool Max depth (ft)	0.9	1.3		1.6		2																														
Pool Spacing (ft)	17	24		47		23																														
Pattern																																				
Channel Beltwidth (ft)	17	24		36																																
Radius of Curvature (ft)	11	18		59																																
Rc:Bankfull width (ft/ft)	2	3		10																																
Meander Wavelength (ft)	35	50		71																																
Meander Width Ratio	3	4		6																																
Additional Reach Parameters																																				
Rosgen Classification	C 4																																			
Channel Thalweg length (ft)	605																																			
Sinuosity (ft)	1.15																																			
Water Surface Slope (Channel) (ft/ft)	0.0138																																			
BF slope (ft/ft)																																				
[3]Ri% / Ru% / P% / G% / S%	41	20	20	19																																
[3]SC% / Sa% / G% / C% / B% / Be%																																				
[3]d16 / d35 / d50 / d84 / d95 /																																				
[2]% of Reach with Eroding Banks	**0**																																			
Channel Stability or Habitat Metric																																				
Biological or Other																																				

Pattern data will not typically be collected unless visual data, dimensional data or profile data indicate significant shifts from baseline

Shaded cells indicate that these will typically not be filled in.
1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile.
2 = Proportion of reach exhibiting banks that are eroding based on the visual survey from visual assessment table
3 = Riffle, Run, Pool, Glide, Step; Silt/Clay, Sand, Gravel, Cobble, Boulder, Bedrock; dip = max pave, disp = max subpave
4. = Of value/needed only if the n exceeds 3

Appendix E
Groundwater Gauge Soil Profiles

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Haw River Wetland

County, State: Alamance, North Carolina

Sampling Point/ Coordinates: GW-01

Investigator: Perkins

Notes:
Soil described during
Capture

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-8	2.5Y 5-2	80	2.5Y 4-6	20	SiCL
8-20	2.5Y 4-2	60	2.5Y 4/6	40	CL
20-35	5Y 7-2	80	2.5Y 4-4	20	SiCL → Saprolite

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Haw River Slocum's Wetland

County, State: Alamance, NC

Sampling Point/ Coordinates: GW-02

Investigator: PerKinson

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	10yr 4-3	80	10yr 4-6	20	CL
5-20	10yr 4-2	75	10yr 4-6	25	CL
20-38	10yr 4-1	80	10yr 4-6	20	C

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Flow Stream and Wetland

County, State: Alamance, NC

Sampling Point/ Coordinates: GW-03

Investigator: P-Kenyon

Notes:

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-6	10yr 4-4	90	10yr 4-6	10	cC
6-12	10yr 5-2	80	10yr 4-6	20	CC
12-30	10yr 7-1	80	10yr 4-6	20	SiC
30+	saprolite/rocks				

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Project/Site: Hebron Stream/wetland

County, State: Alamance, NC

Sampling Point/ Coordinates: 4-6

Investigator: P. Perkinson

Notes:
3 gauge transect located in old pond, soil/gauge gauge for each gauge - Saturated, 2" surface water soil mobile disturbed!

Depth (inches)	Matrix		Mottling		Texture
	Color	%	Color	%	
0-5	2.5Y 5-1	60	2.5Y 6-0	40	SiCL
5-10	GLY	80	2.5, 4-4	20	SiCL
10-25	GLY	90	2.5Y 4-4	10	SiCL
25-34	2.5Y 5-2	90	2.5Y 4-6	10	SiCL
34+	Saprolite/Bedrock				

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

Appendix F
Preconstruction Benthic Data

Preconstruction Benthic Results
Habitat Assessment Dataforms

PA ID NO			**51818**	**51819**
STATION			**UT-1 Llower**	**UT-5**
DATE			**10/2/2018**	**10/2/2018**
SPECIES	**T.V.**	**F.F.G.**		
MOLLUSCA				
Bivalvia				
Veneroida				
Sphaeriidae		**FC**		
Pisidium sp.	6.6	**FC**	5	
Gastropoda				
Basommatophora				
Physidae				
Physella sp.	8.7	**CG**	32	
ANNELIDA				
Clitellata				
Oligochaeta		**CG**		
Tubificida				
Tubificinae w.o.h.c.		**CG**		3
ARTHROPODA				
Crustacea				
Copepoda				
Cyclopoida			1	
Isopoda				
Asellidae		**SH**		
Caecidotea sp.	8.4	**CG**	1	
Lirceus sp.	7.4	**CG**		1
Amphipoda		**CG**		
Crangonyctidae				
Crangonyx sp.	7.2	**CG**	12	12
Insecta				
Odonata				
Coenagrionidae		**P**		
Ischnura sp.	9.5		1	1
Corduliidae			1	
Coleoptera				
Dytiscidae		**P**		
Neoporus carolinus	5		1	1
Diptera				
Chironomidae				
Chironomus sp.	*9.3*	**CG**	3	
Goeldichironomus holoprasinus			15	
Polypedilum illinoense gp.	*8.7*	**SH**	2	
Polypedilum scalaenum gp.	*8.5*	**SH**		1
Zavrelimyia sp.	*8.6*	**P**		1
Culicidae		**FC**		

PA ID NO			51818	51819
STATION			UT-1 Llower	UT-5
DATE			10/2/2018	10/2/2018
SPECIES	T.V.	F.F.G.		
Aedes sp.			1	1
TOTAL NO. OF ORGANISMS			75	21
TOTAL NO. OF TAXA			12	8
EPT TAXA			0	0
BIOTIC INDEX ASSIGNED VALUES			7.94	7.40

HERON UT-

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE** 56

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

HERON
Stream UT-1 LOWER Location/road: SNOWCAMP (Road Name BETHEL SOUTH FORK Rd.) County ALAMANCE

Date 10-2-18 **CC#** _____ Basin CAPE FEAR BASIN Subbasin 030300020500 5 (NCDNR 03-06-04)
03030002

Observer(s) S. IDARI A. VEITH Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.853955 Longitude -79.363458 Ecoregion: ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 8 %Forest 2 %Residential 90 %Active Pasture _____ % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : ☐Forest ☒Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 1-2 Channel (at top of bank) 2-4 **Stream Depth**: (m) Avg 2" Max 12" (pools)
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 6"

Bank Angle: 45-90° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☒Deeply incised-steep, straight banks ☒Both banks undercut at bend ☒Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☒N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☐Normal ☒Low
Turbidity: ☐Clear ☐ Slightly Turbid ☒Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒YES ☐NO Details _____
Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☒
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: Cloudy-Mid 70's **Photos:** ☐N ☐Y ☐ Digital ☐35mm

Remarks: _____

Stream in Active cattle pasture - little to no woody stream buffer ~ grasses/ shrubs only - riffels trampled by livestock

HERON UT-1

I. Channel Modification

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 4

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

C **Rocks** R **Macrophytes** C **Sticks and leafpacks** R **Snags and logs** C **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks few trees Subtotal 15

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

A. substrate with good mix of gravel, cobble and boulders	**Score**
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 4

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

A. Pools present	Score
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 10

☐ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total 33

Heron UT-1

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 7

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 4

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____ Subtotal 2

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM	Lft. Bank Score	Rt. Bank Score
Dominant vegetation: ☐ Trees ☐ Shrubs ☑ Grasses ☑ Weeds/old field ☐Exotics (kudzu, etc)		
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

Remarks_____ Total 10

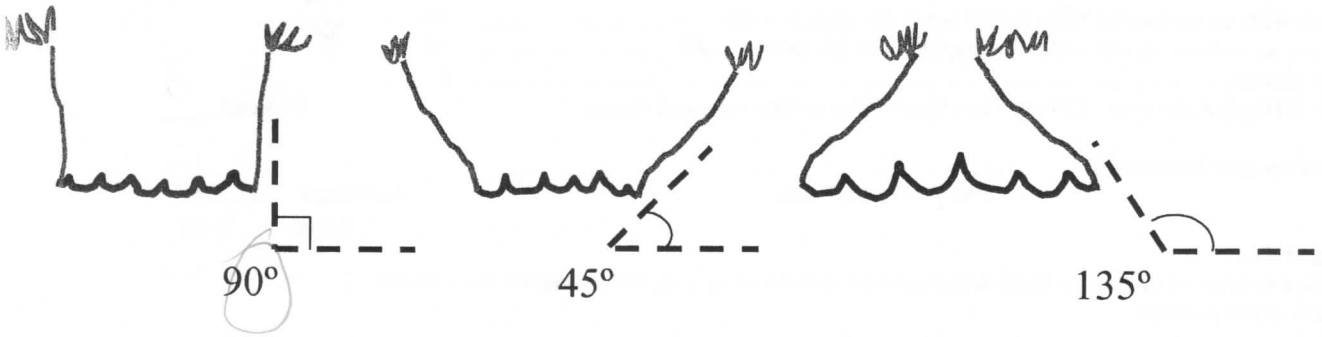
Page Total 23

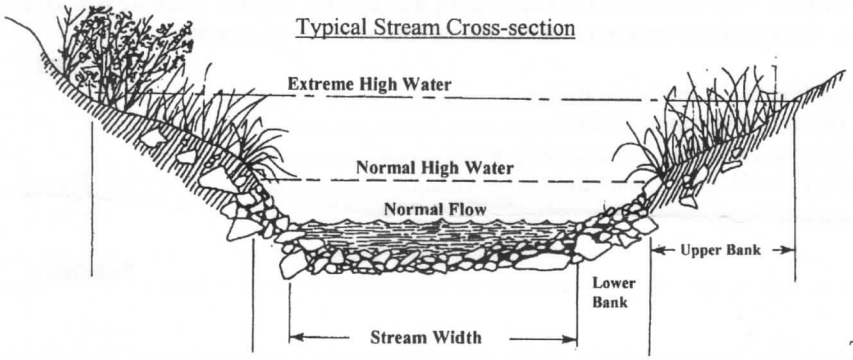
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 56

Heron
UT-1

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:_____

_____

_____

_____

_____

HERON UT-5

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE 48**

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream UT-5 HERON Location/road: SNOW CAMP (Road Name BETHEL SOUTH FORK Rd.) County ALAMANCE

Date 10-2-18 **CC#** _____ Basin CAPE FEAR BASIN 03030002 Subbasin 030300020500 56 (NCDWR 03-06-04)

Observer(s) G. LEWIS A. KEITH Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Latitude 35.852447 Longitude -79.361752 Ecoregion: ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature _____ °C DO _____ mg/l Conductivity (corr.) _____ µS/cm pH _____

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 8 %Forest 2 %Residential 90 %Active Pasture _____ % Active Crops
_____ %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : ☐Forest ☒Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 1-2 Channel (at top of bank) 3 **Stream Depth**: (m) Avg 3" Max 6"
☐ Width variable ☐ Large river >25m wide
Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 1

Bank Angle: 90 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
~~☐Deeply incised-steep~~, straight banks ☐Both banks undercut at bend ☒Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☒N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☐Normal ☒Low
Turbidity: ☐Clear ☐ Slightly Turbid ☒Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☒**YES** ☐**NO Details** _____

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☒
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: Cloudy - mid 70's **Photos:** ☒N ☐Y ☐ Digital ☐35mm

Remarks: Stream within cattle pasture - narrow channel with dense vegetation - NO woody vegetation

I. Channel Modification

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	(3)
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 3

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as **R**are, **C**ommon, or **A**bundant.

R **Rocks** R **Macrophytes** C **Sticks and leafpacks** R **Snags and logs** C **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	11	7
2 types present	18	14	(10)	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal 10

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

A. substrate with good mix of gravel, cobble and boulders	**Score**
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	(4)
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 4

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

A. Pools present	Score
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	(4)
B. Pools absent	0

Subtotal 4

☐ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____

Page Total 21

HERON UT-1

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream Subtotal 3

VI. Bank Stability and Vegetation

FACE UPSTREAM	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 14

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks_____ Subtotal 0

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

Remarks_____ Total 10

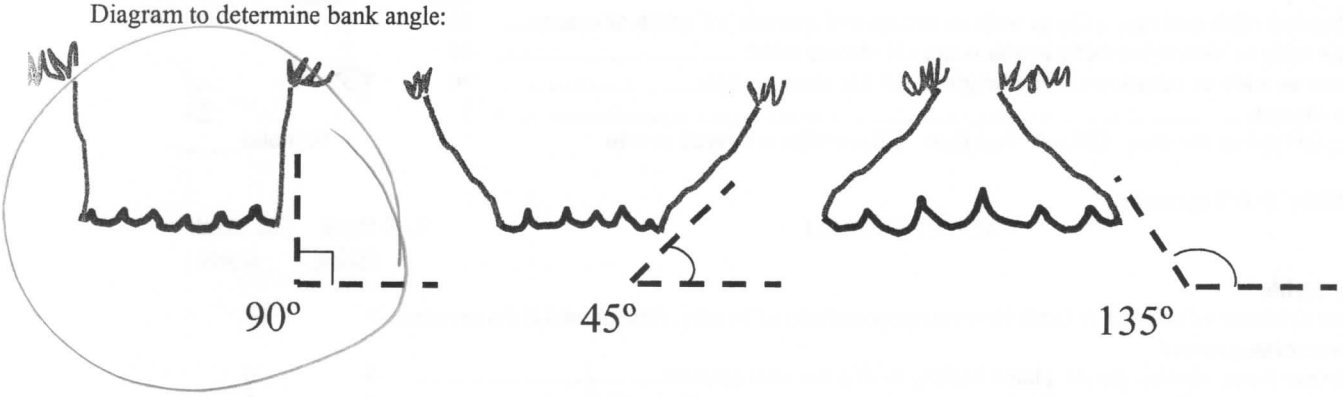
Page Total 27

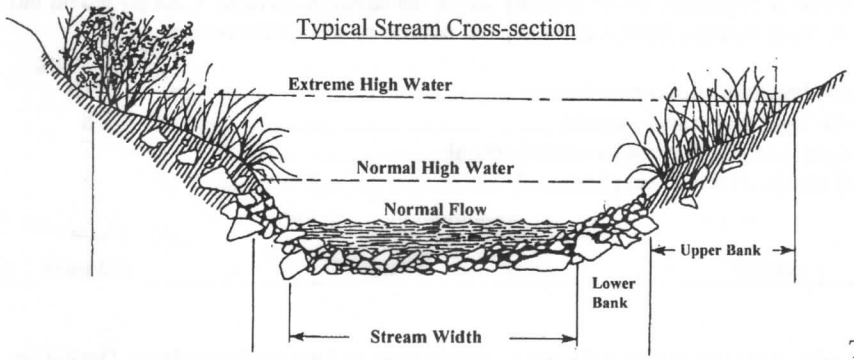
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 48

Heron
Ut - 5

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments: _____

_____

_____

_____

_____

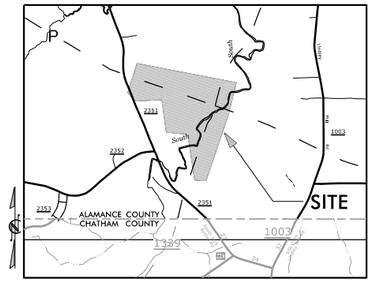
Appendix G
As-built Plan Sheets

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HERON SITE	1	

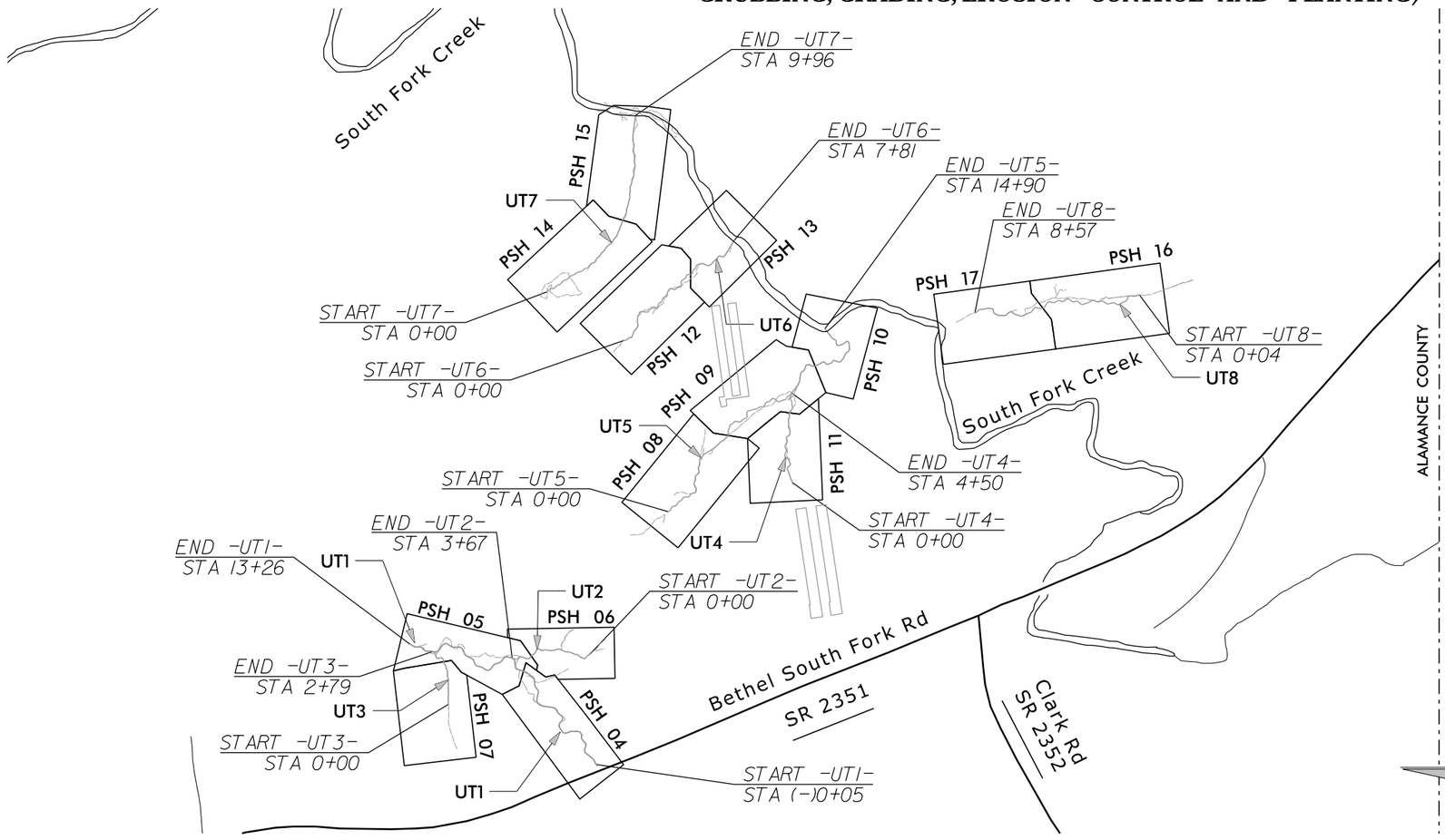
AS–BUILT PLANS
HERON SITE

LOCATION: ALAMANCE COUNTY, NORTH CAROLINA

TYPE OF WORK: STREAM RESTORATION AND ENHANCEMENT (CLEARING, GRUBBING, GRADING, EROSION CONTROL AND PLANTING)



VICINITY MAP
Not to Scale



INDEX OF SHEETS

SHEET NUMBER	SHEET
01	Title Sheet
01A	Symbology Sheet
04 THRU 17	As-Built Plan and Profile Sheets

SURVEYORS CERTIFICATION(S)

Surveyor's disclaimer: No attempt was made to locate any cemeteries, wetlands, hazardous material sites, underground utilities or any other features above, or below ground other than those shown. However, no visible evidence of cemeteries or utilities, aboveground or otherwise, was observed by the undersigned (other than those shown).

I certify that the survey is of an existing parcel or parcels of land or one or more existing easements and does not create a new street or change an existing street.

I JOHN A. RUDOLPH , certify that this plat was prepared under my supervision from an actual field survey made under my supervision, of as-built conditions.

That the boundaries not surveyed are clearly indicated as such and were plotted from information as referenced hereon; That the ratio of precision as calculated was 1:7,500+ and that the global navigational satellite system (GNSS) was used to perform this survey and the following information was used:
Class of Survey: CLASS B (HORIZONTAL) CLASS B (VERTICAL)
Positional Accuracy: 0.12 feet (HORIZONTAL)
Type of GPS field procedure: RTK
Dates of survey: February 2019
Datum/Epoch: NAD 1983(2011)
Published/Fixed Control Use: OPUS
Geoid Model: 2012B CONUS
Combined Grid Factor: 0.99990680 GROUND TO GRID
Units: US SURVEY FEET

That this plat meets the requirements of the standards of practice for land surveying in North Carolina. Witness my hand and seal this 02 day of May , 2019

NORTH CAROLINA PROFESSIONAL SEAL L-4194 LAND SURVEYOR JOHN ASHLEY RUDOLPH

5/31/2019

DocuSigned by:
John Rudolph
1C9D7388B9B645D...

Professional Land Surveyor — L-4194 License Number

LIMITS OF CONSTRUCTION: 7.8 ACRES

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

CONTRACT: HERON SITE

GRAPHIC SCALES

50 25 0 50 100
PLANS

50 25 0 50 100
PROFILE (HORIZONTAL)

10 5 0 10 5
PROFILE (VERTICAL)

PROPOSED LENGTH OF UT1= 1331 LF
PROPOSED LENGTH OF UT2= 367 LF
PROPOSED LENGTH OF UT3= 279 LF
PROPOSED LENGTH OF UT4= 450 LF
PROPOSED LENGTH OF UT5= 1490 LF
PROPOSED LENGTH OF UT6= 781 LF
PROPOSED LENGTH OF UT7= 996 LF
PROPOSED LENGTH OF UT8= 853 LF

TOTAL STREAM LENGTH= 6547 LF

RESTORATION LEVEL	STREAM (linear footage)	RIPARIAN WETLAND (acreage)	NONRIPARIAN WETLAND (acreage)
RESTORATION	4218	0.35	–
ENHANCEMENT	2329	–	–
TOTALS	6547	0.61	–
MITIGATION UNITS	5293 SMUs	0.66 RIPARIAN WMUs	– NONRIPARIAN WMUs

Designed By:

Axiom Environmental, Inc.
218 Snow Ave
Raleigh, NC 27603

GRANT LEWIS
PROJECT DESIGNER

RESTORATION SYSTEMS LLC
Restoration Systems
1101 Haynes St.
Suite 211
Raleigh, NC 27604

WORTH CREECH
SITE CONSTRUCTION MANAGER

Prepared in the Office of:

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

JOSHUA G. DALTON, P.E.
PROJECT ENGINEER

DocuSigned by:
Josh Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

5/31/2019
DATE:

5/1/2019
Heron_psh_AB_01.dgn
jharvey

CONVENTIONAL PLAN SHEET SYMBOLS

Note: Not to Scale **S.U.E. = Subsurface Utility Engineering*

SHEET NAME		SHEET NUMBER
SYMBOLOGY		01A
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.
SUNGATE DESIGN GROUP, P.A.
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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
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BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin (EIP)
- Computed Property Corner
- Property Monument (ECM)
- Parcel/Sequence Number (123)
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary (WLB)
- Proposed Wetland Boundary (WLB)
- Existing Endangered Animal Boundary (EAB)
- Existing Endangered Plant Boundary (EPB)
- Existing Historic Property Boundary (HPB)

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign (S)
- Well (W)
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream (JS)
- Buffer Zone 1 (BZ 1)
- Buffer Zone 2 (BZ 2)
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch (FLOW)

RIGHT OF WAY & PROJECT CONTROL:

- Secondary Horiz and Vert Control Point
- Primary Horiz Control Point
- Primary Horiz and Vert Control Point

- Exist Permanent Easment Pin and Cap
- New Permanent Easement Pin and Cap
- Vertical Benchmark
- Existing Right of Way Marker
- Existing Right of Way Line
- New Right of Way Line (RW)
- New Right of Way Line with Pin and Cap (RW)
- New Right of Way Line with Concrete or Granite R/W Marker (RW)
- New Control of Access Line with Concrete C/A Marker (CA)
- Existing Control of Access (CA)
- New Control of Access (CA)
- Existing Easement Line (E)
- New Conservation Easement (E)
- New Temporary Drainage Easement (TDE)
- New Permanent Drainage Easement (PDE)
- New Permanent Drainage / Utility Easement (DUE)
- New Permanent Utility Easement (PUE)
- New Temporary Utility Easement (TUE)
- New Aerial Utility Easement (AUE)

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut (C)
- Proposed Slope Stakes Fill (F)
- Proposed Curb Ramp (CR)
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert (CONC)
- Bridge Wing Wall, Head Wall and End Wall (CONC WW)

MINOR:

- Head and End Wall (CONC HW)

- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB (CB)
- Paved Ditch Gutter
- Storm Sewer Manhole (S)
- Storm Sewer (S)

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole (P)
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole
- H-Frame Pole
- U/G Power Line LOS B (S.U.E.*) (P)
- U/G Power Line LOS C (S.U.E.*) (P)
- U/G Power Line LOS D (S.U.E.*) (P)

TELEPHONE:

- Existing Telephone Pole

WATER:

- Water Manhole (W)
- Water Meter
- Water Valve
- Water Hydrant
- U/G Water Line LOS B (S.U.E*) (W)
- U/G Water Line LOS C (S.U.E*) (W)
- U/G Water Line LOS D (S.U.E*) (W)
- Above Ground Water Line (A/G Water)

GAS:

- Gas Valve
- Gas Meter
- U/G Gas Line LOS B (S.U.E.*) (G)
- U/G Gas Line LOS C (S.U.E.*) (G)
- U/G Gas Line LOS D (S.U.E.*) (G)
- Above Ground Gas Line (A/G Gas)

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line (SS)
- Above Ground Sanitary Sewer (A/G Sanitary Sewer)

- SS Forced Main Line LOS B (S.U.E.*) (FSS)
- SS Forced Main Line LOS C (S.U.E.*) (FSS)
- SS Forced Main Line LOS D (S.U.E.*) (FSS)

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box (S)
- Utility Unknown U/G Line LOS B (S.U.E.*) (?UTL)
- U/G Tank; Water, Gas, Oil
- Underground Storage Tank, Approx. Loc. (UST)
- A/G Tank; Water, Gas, Oil
- Geoenvironmental Boring
- U/G Test Hole LOS A (S.U.E.*)
- Abandoned According to Utility Records (AATUR)
- End of Information (E.O.I.)

AS-BUILT:

- Stream Gauge
- Groundwater Gauge (#)
- Benthic & Water Quality Station (1)
- Origin Point on CVS Plots
- CVS Plots (#)
- Cross Section (XS-10R)
- Adjusted Stream Structure
- Not Constructed
- Riffle Rip Rap
- Adjusted Easement (E)

5/1/2019
Plotted: sh_AB_01A.dgn
jharvey

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	4

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

Axiom Environmental, Inc.

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DocuSigned by:
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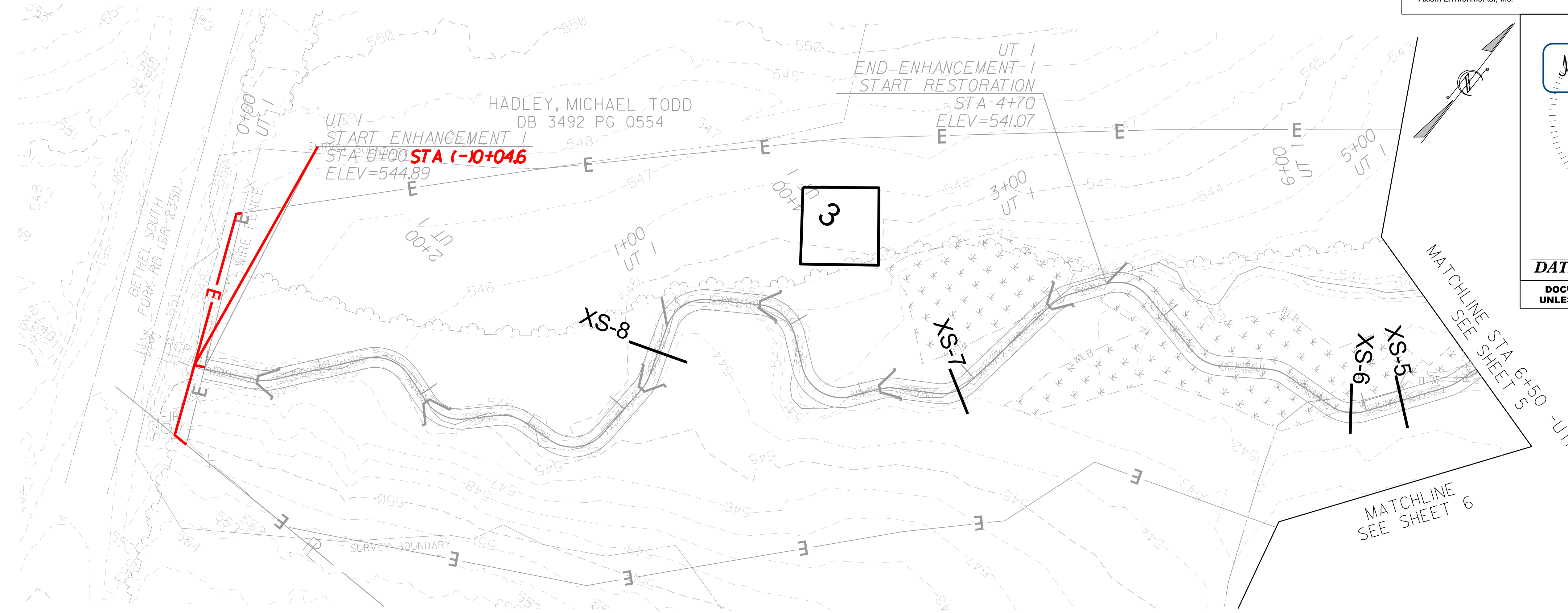
1089AD8C14994C3...

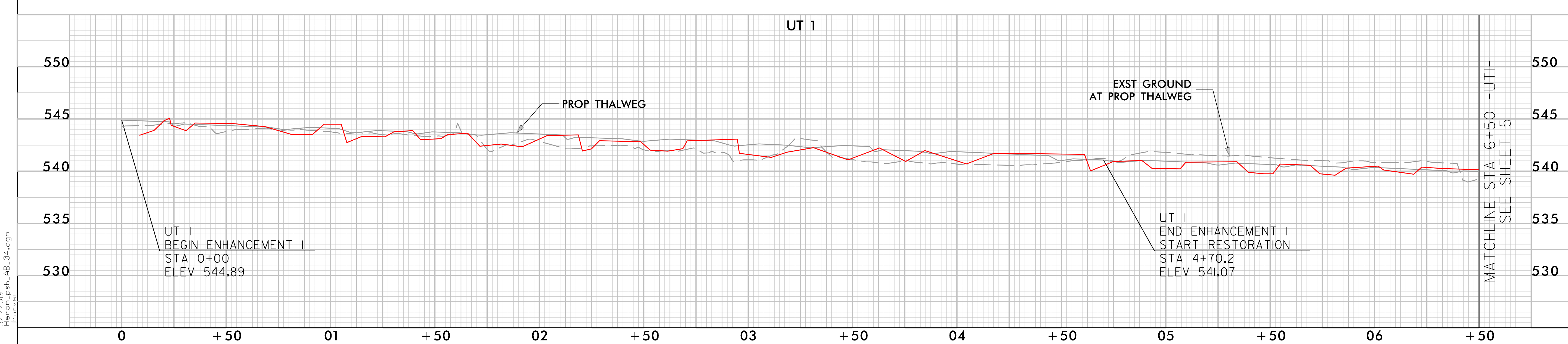
NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

5/31/2019

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED





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jharvey

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	5
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
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5/31/2019

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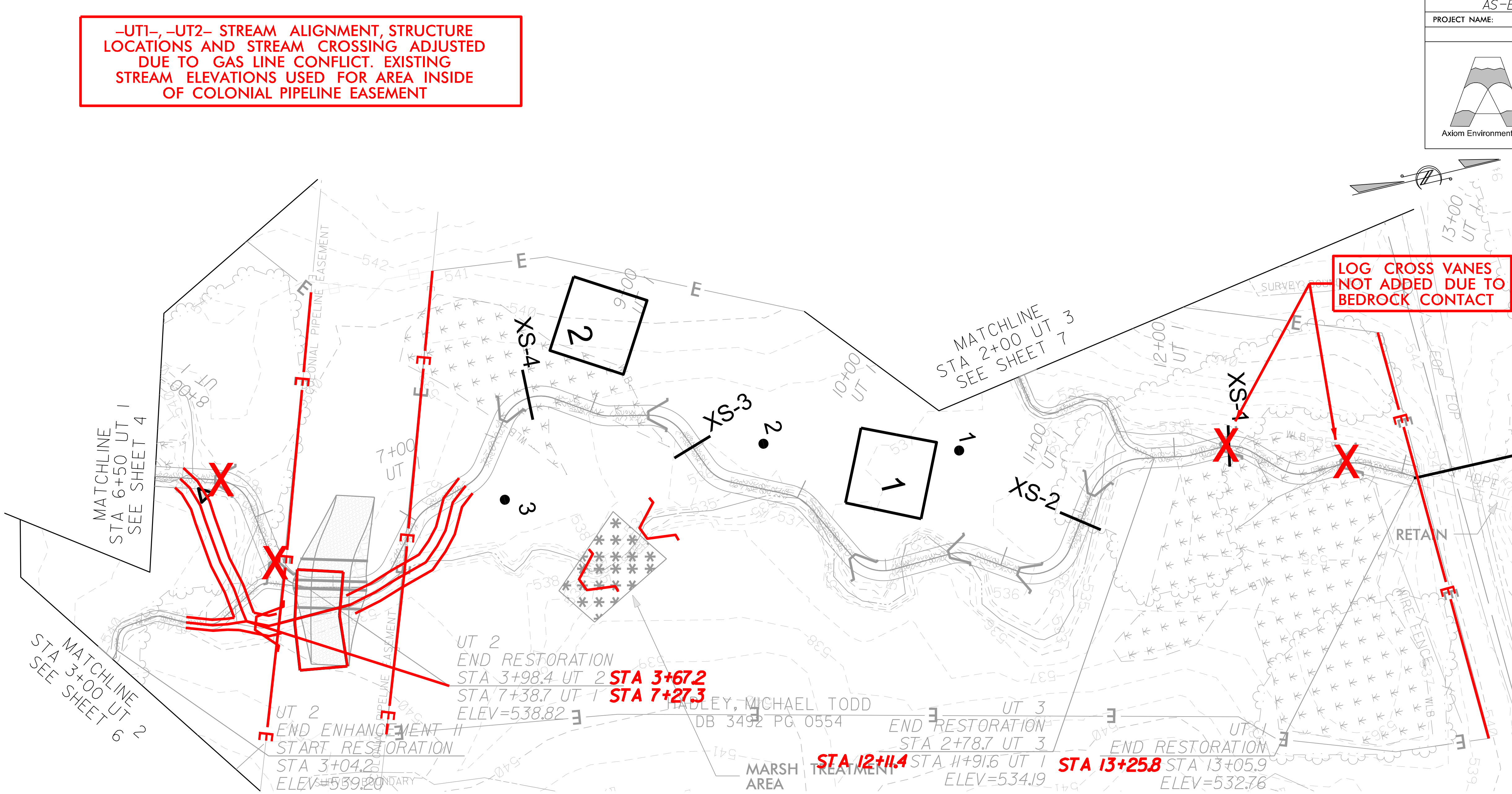

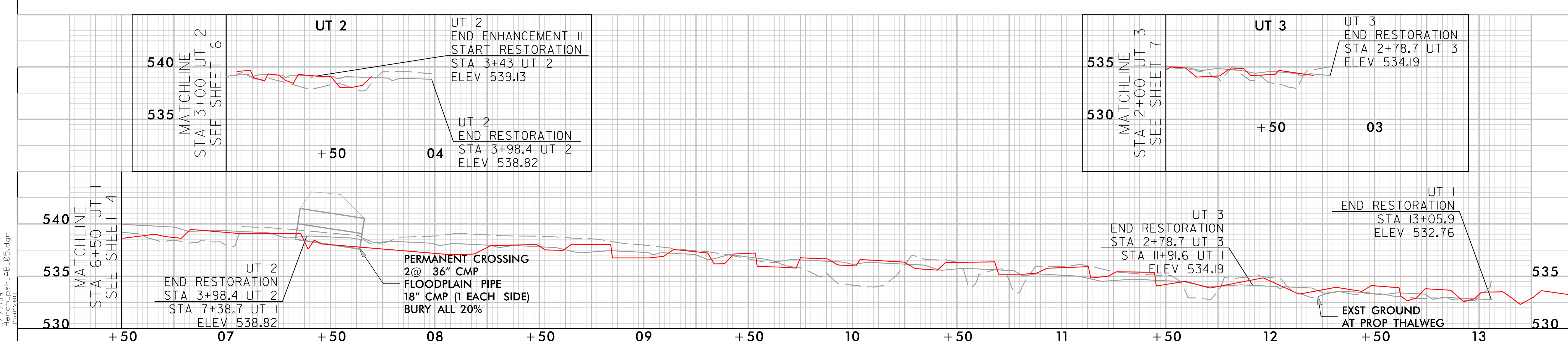

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	6

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
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RALEIGH, NORTH CAROLINA 27606
TEL (919) 859-2243
ENG FIRM LICENSE NO. C-890

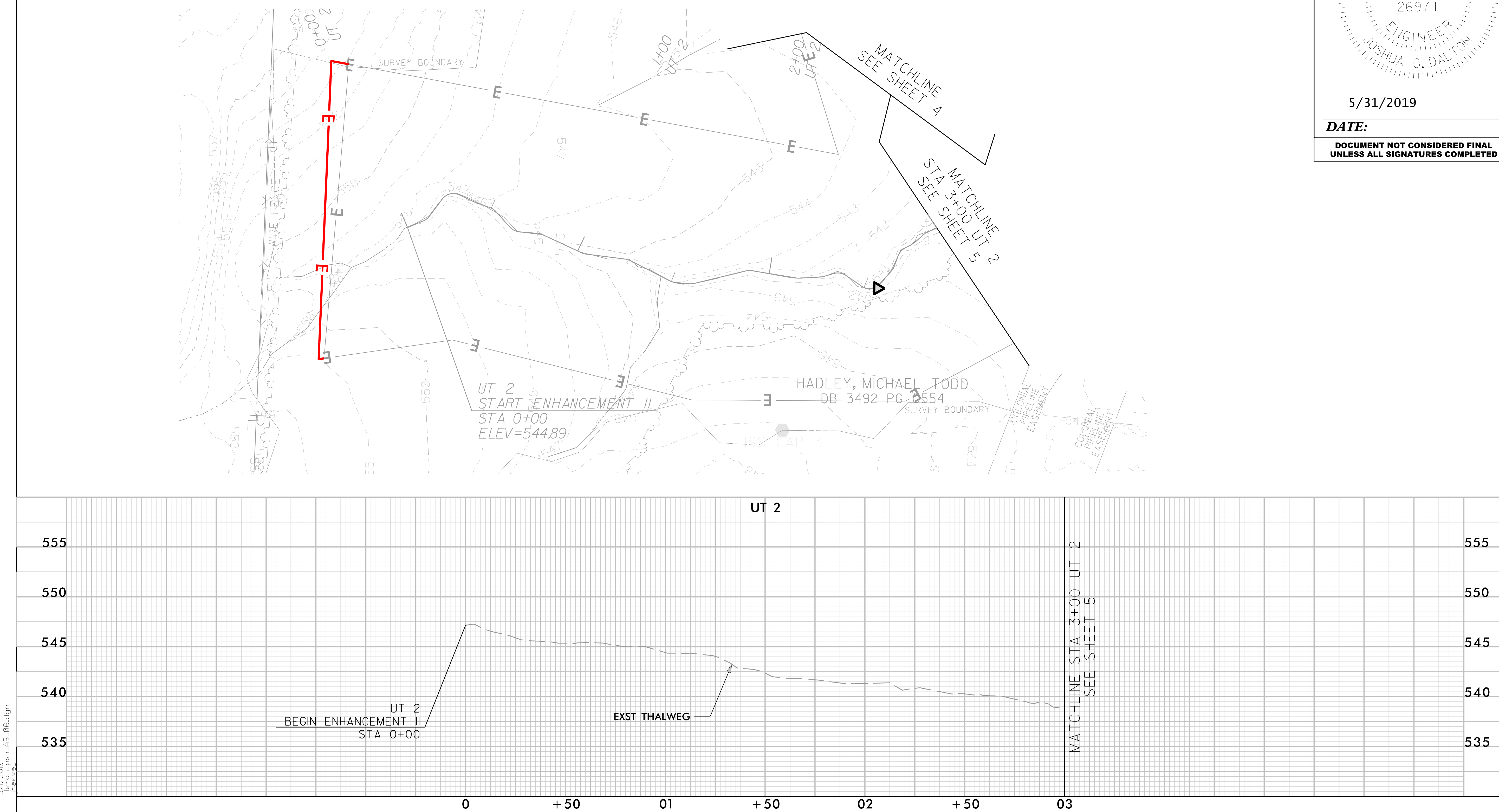
DocuSigned by:
Josh Dalton
1089AD8C14994C3...

NORTH CAROLINA PROFESSIONAL SEAL 26971 ENGINEER JOSHUA G. DALTON

5/31/2019

DATE:

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED



5/1/2019
Heron_psh_AB_06.dgn
jharvey

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	7

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

Axiom Environmental, Inc.

SUNGATE DESIGN GROUP, P.A.
905 JONES FRANKLIN ROAD
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Josh Dalton
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NORTH CAROLINA PROFESSIONAL SEAL 026971 ENGINEER JOSHUA G. DALTON

5/31/2019

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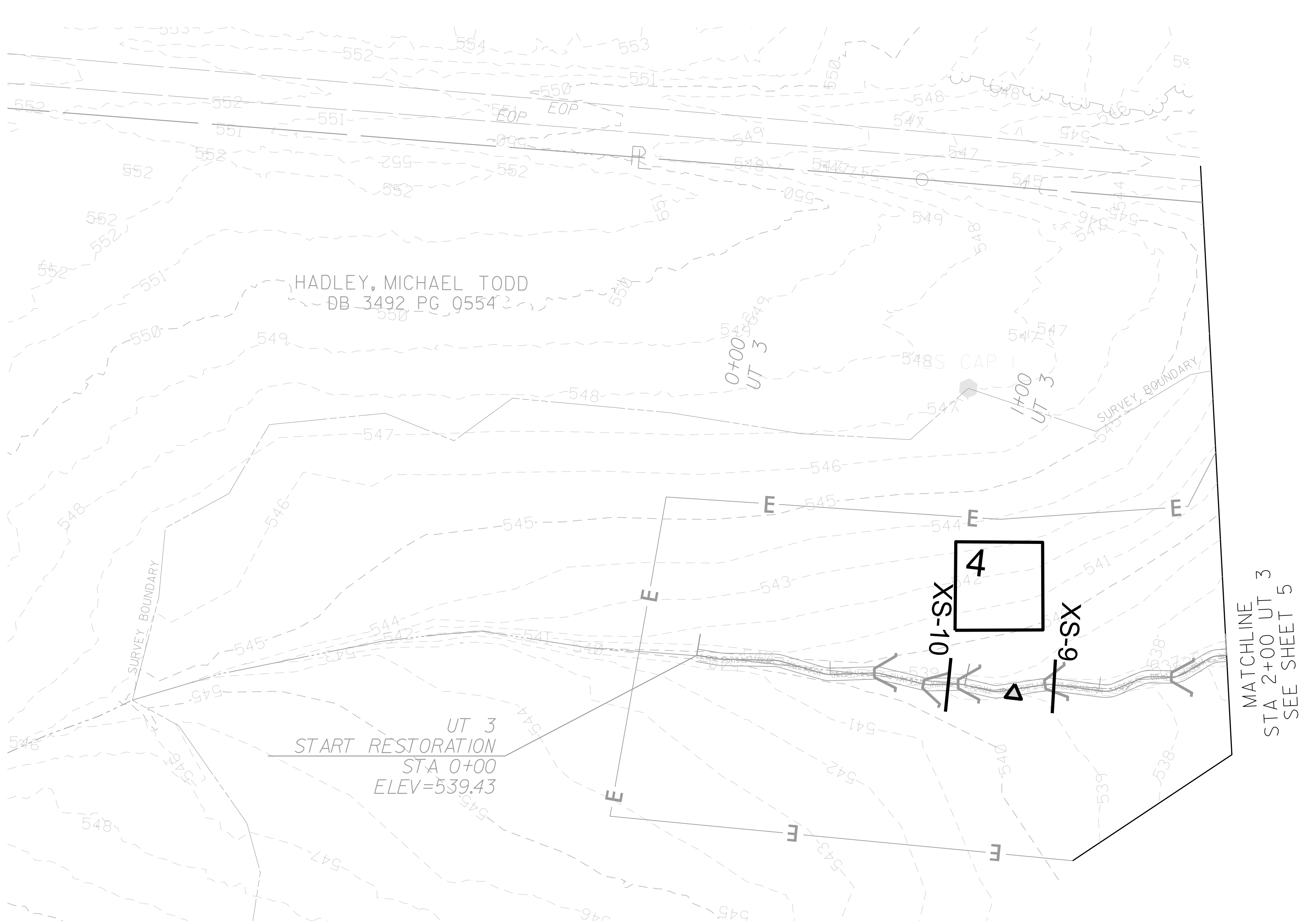

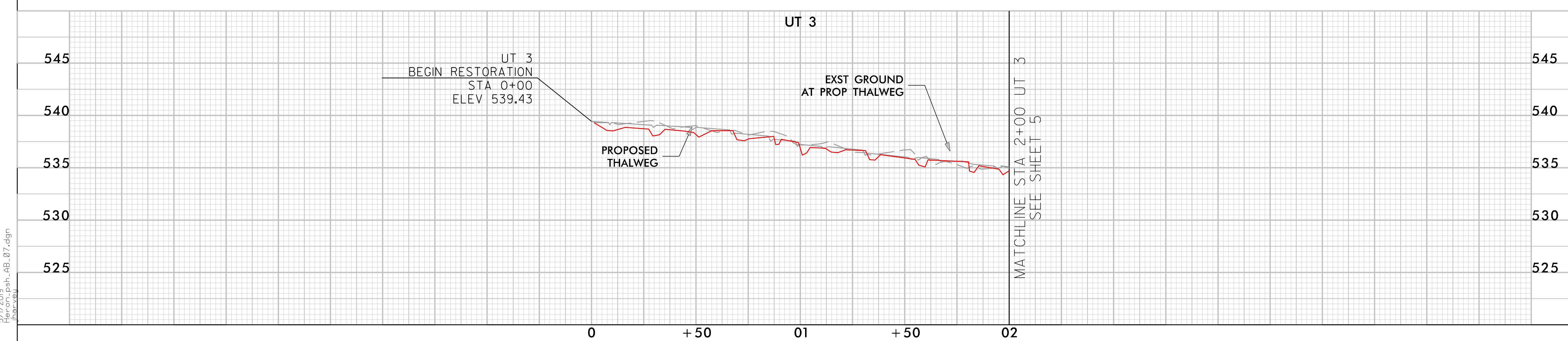

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jharvey

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	8

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

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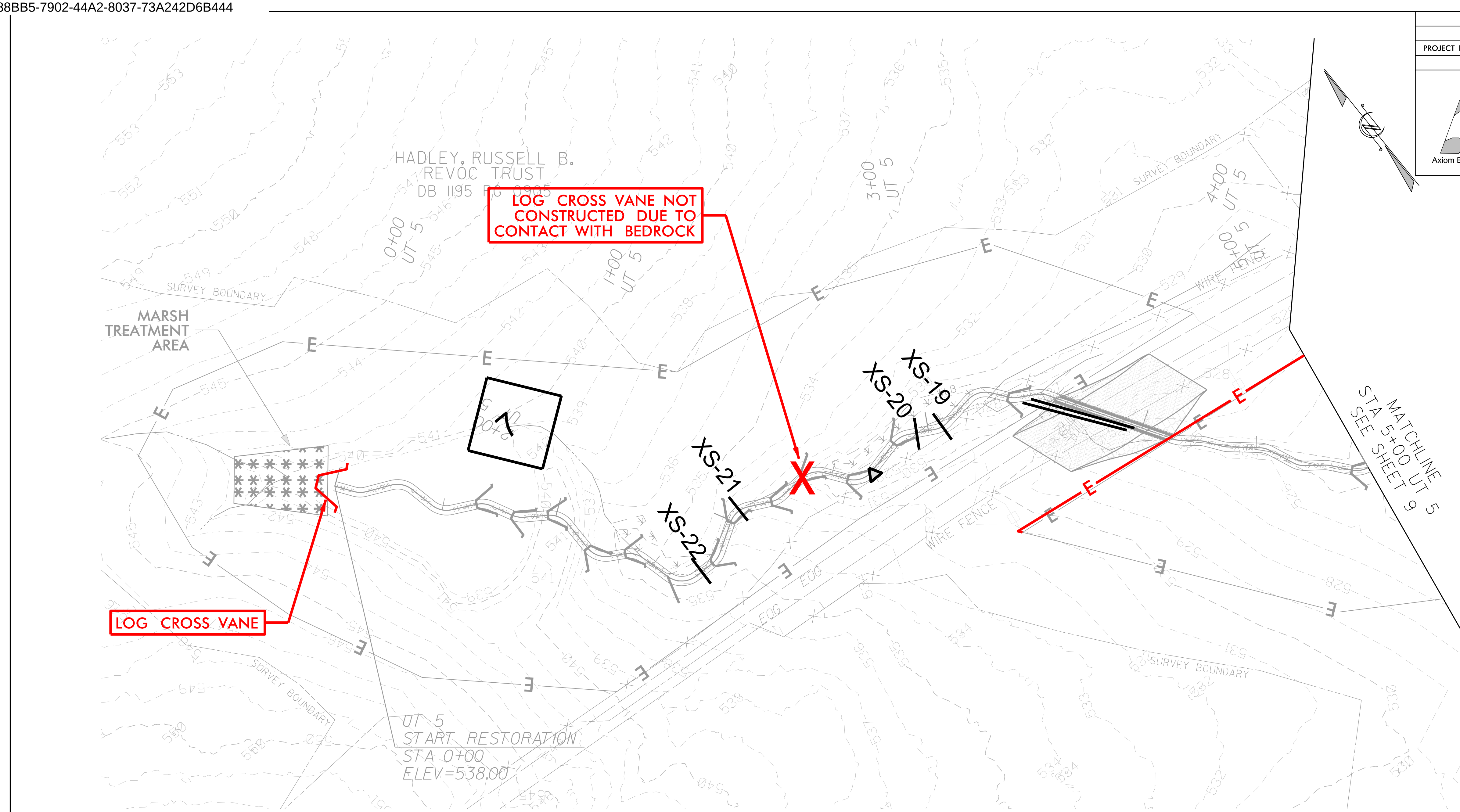

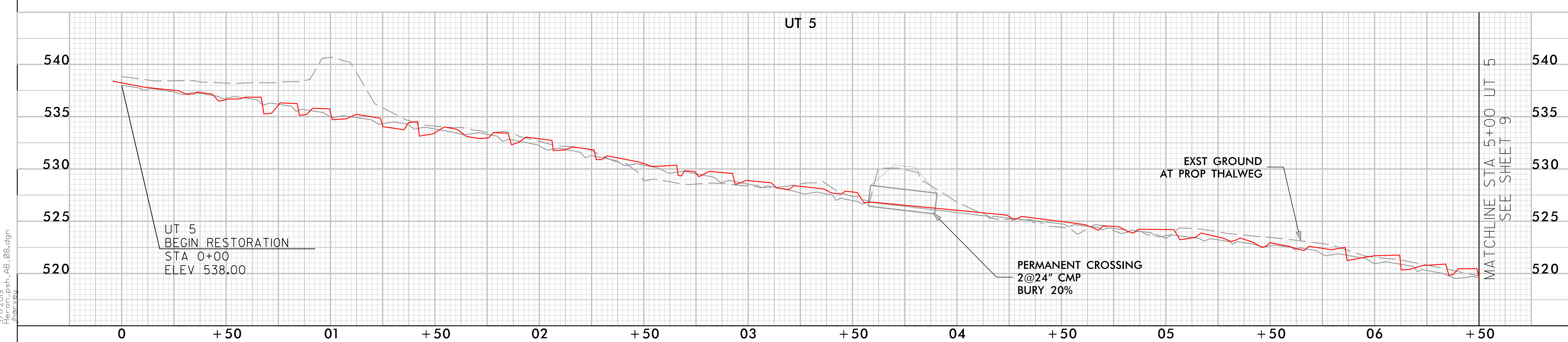

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	9

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

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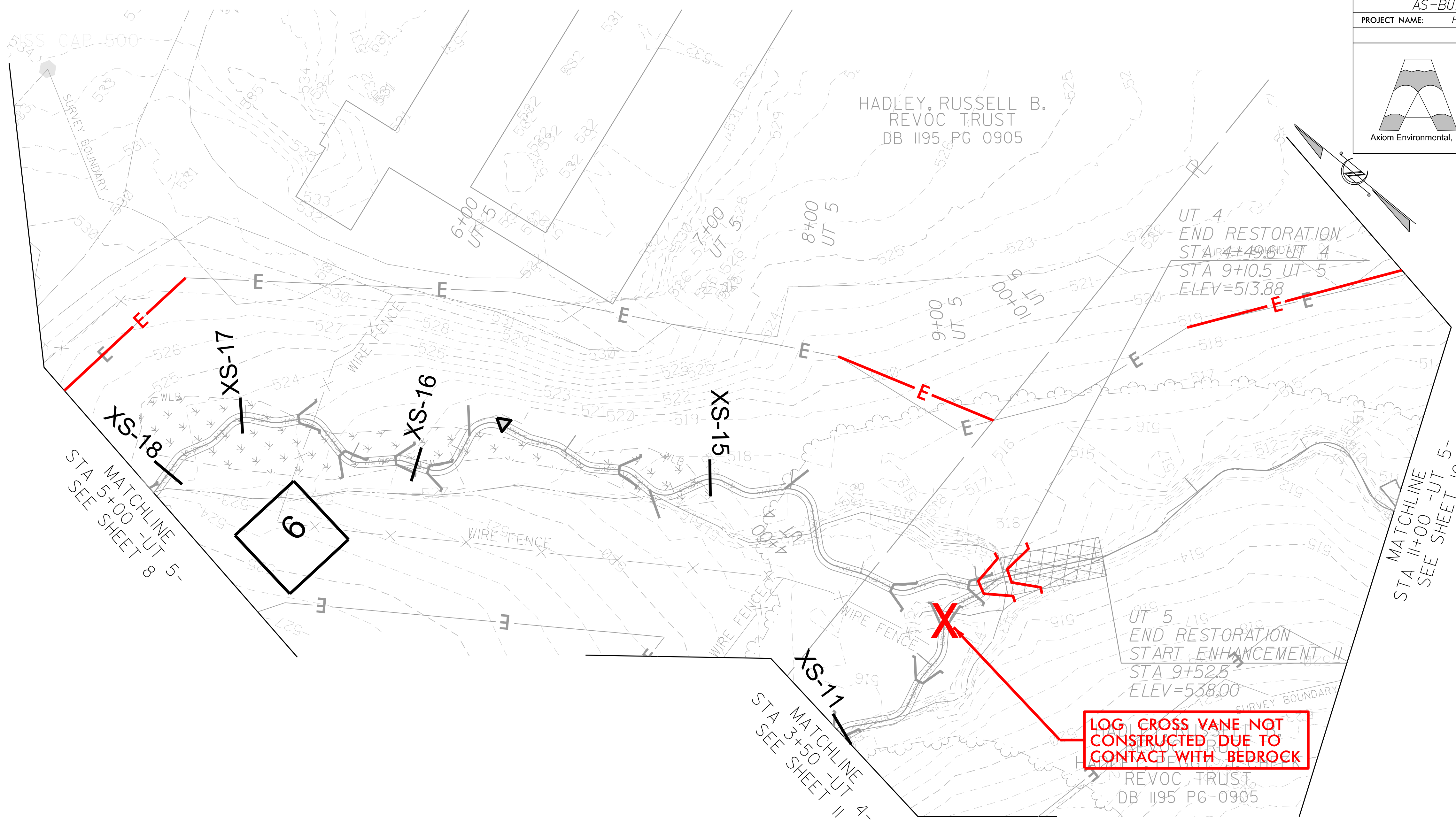

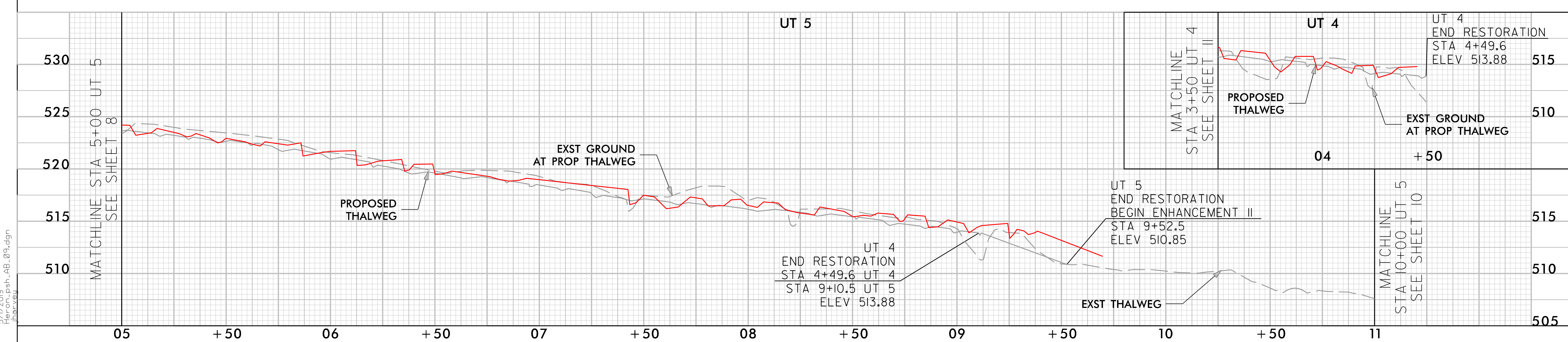

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	10
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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ENGINEER
JOSHUA G. DALTON

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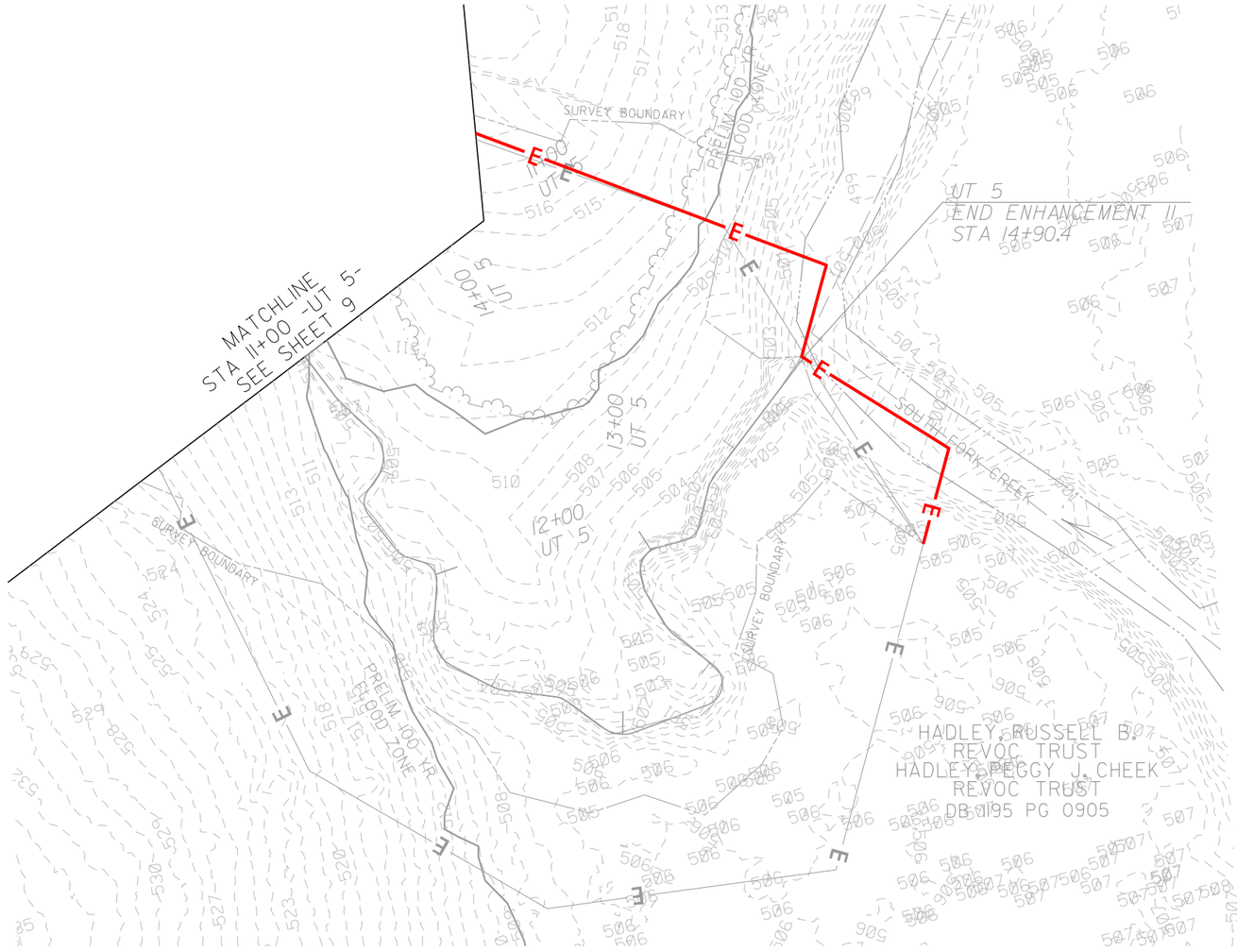

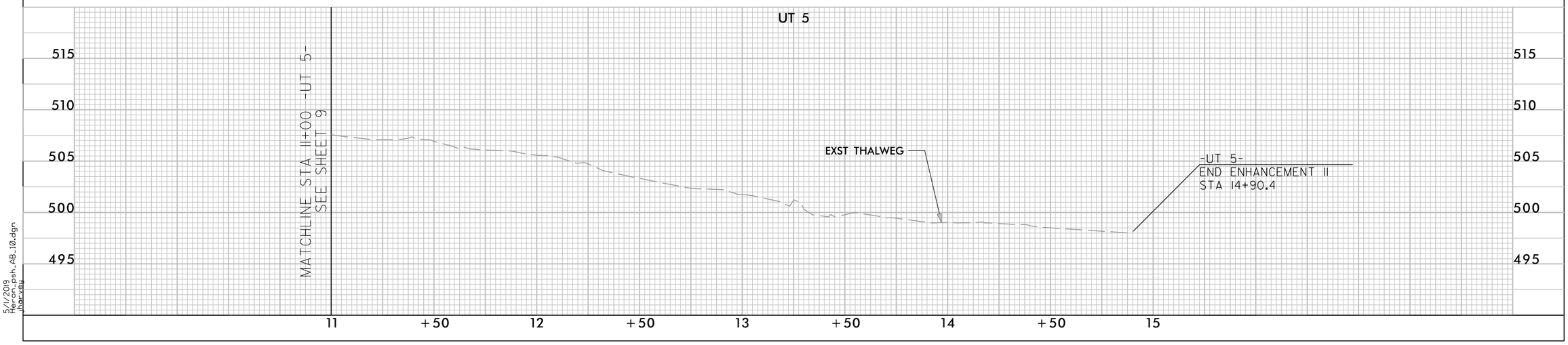

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SHEET NAME		SHEET NUMBER
AS-BUILT STRUCTURES		11
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE		
	COUNTY: ALAMANCE	DATE: 2019

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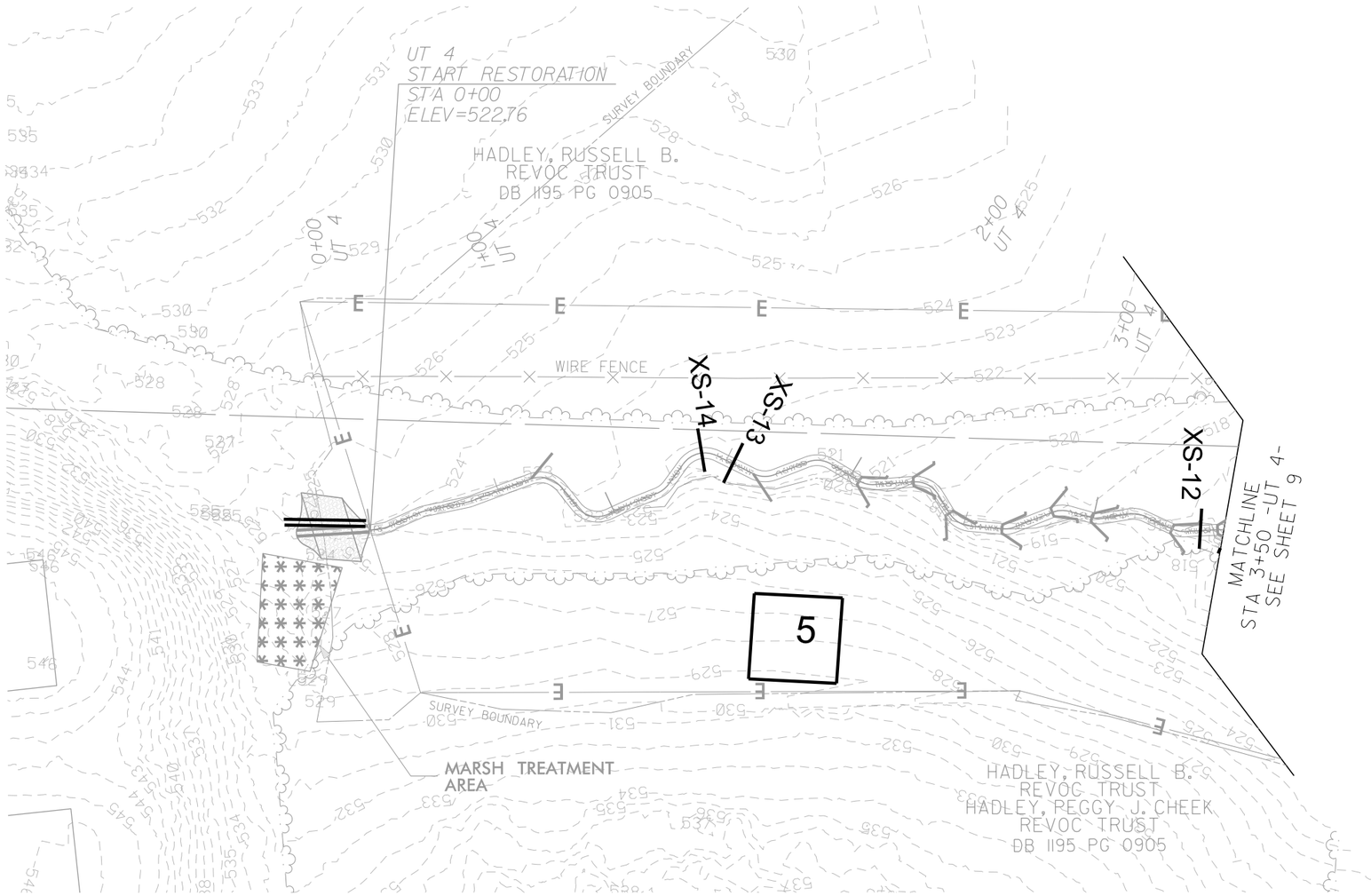

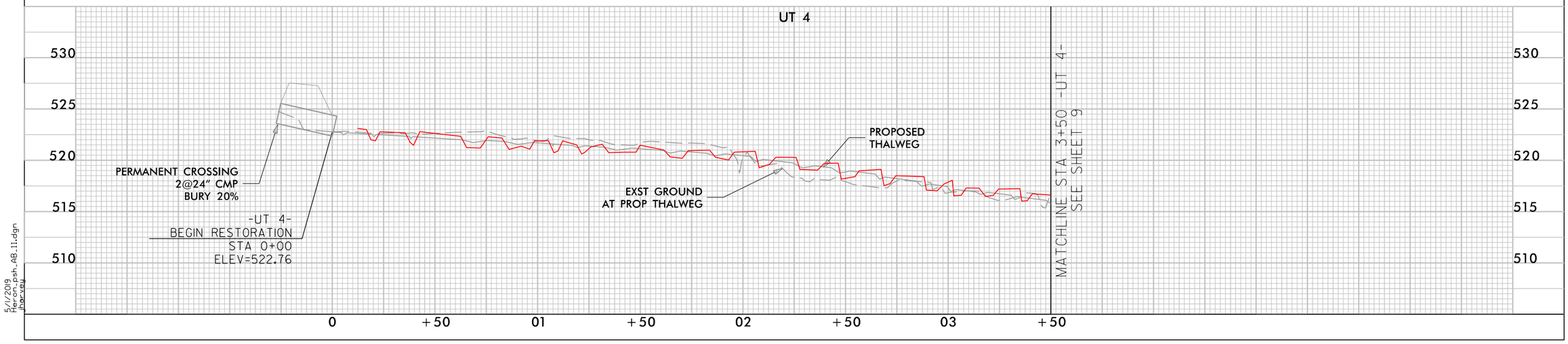

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	12

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

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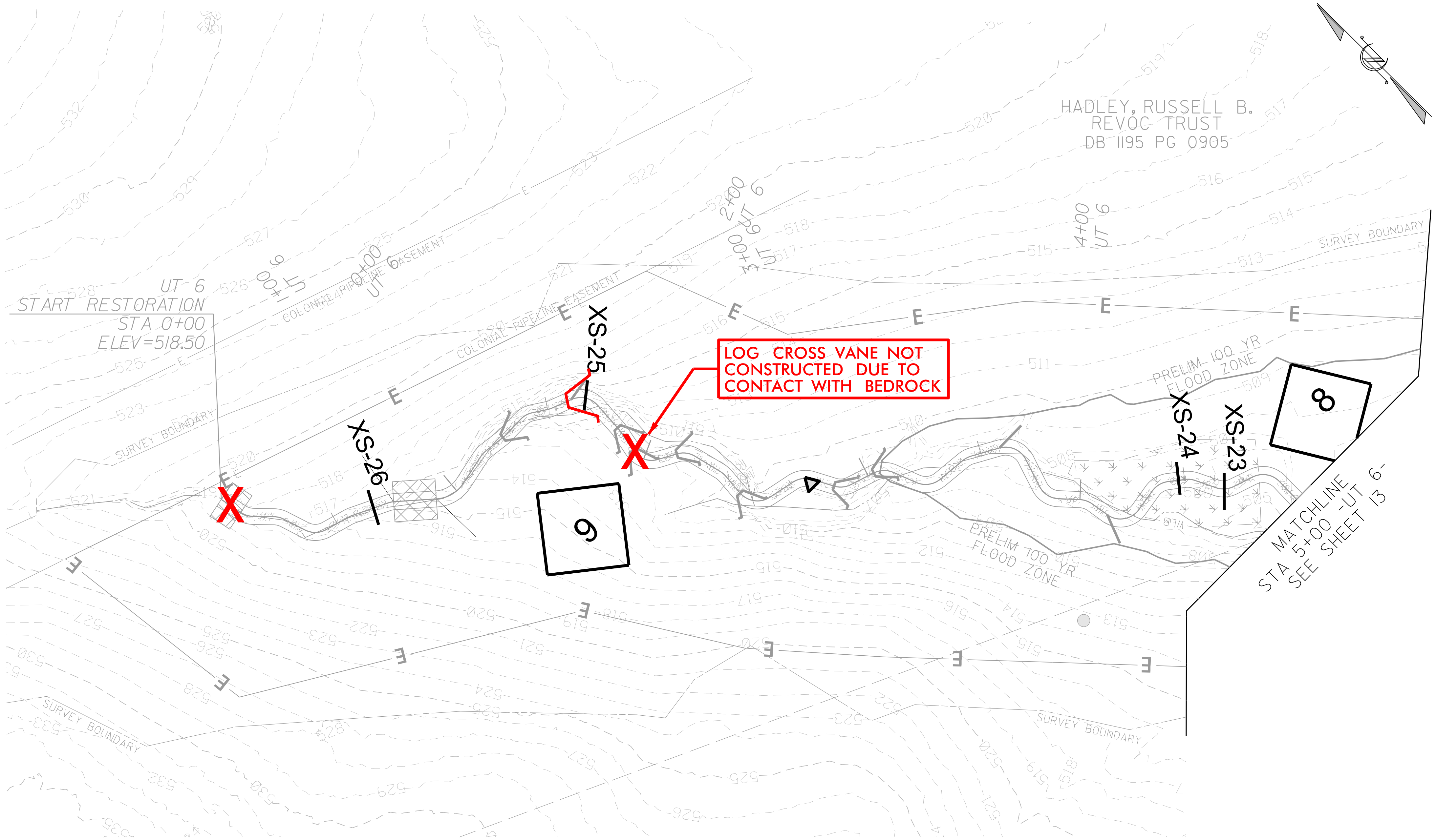

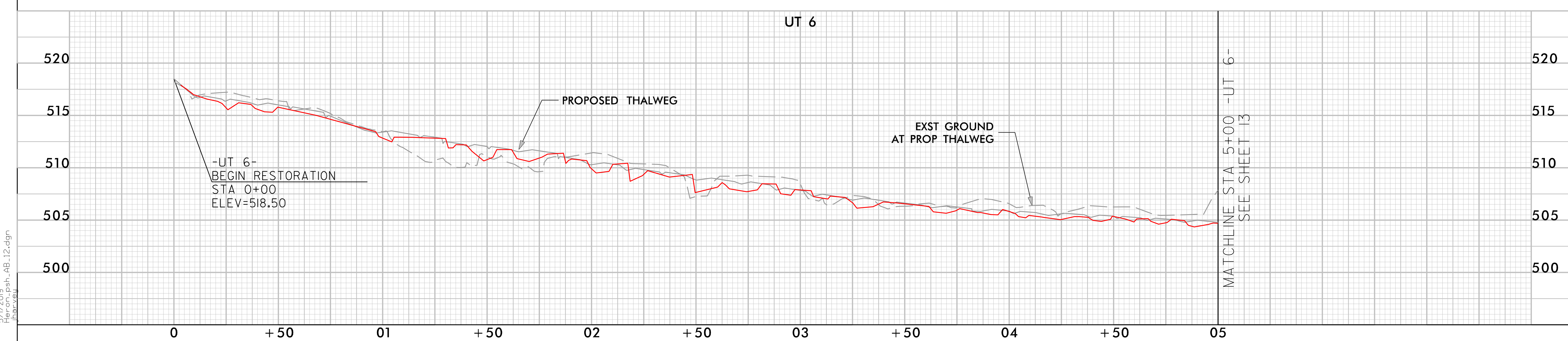

SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	13
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE	
COUNTY: ALAMANCE	DATE: 2019

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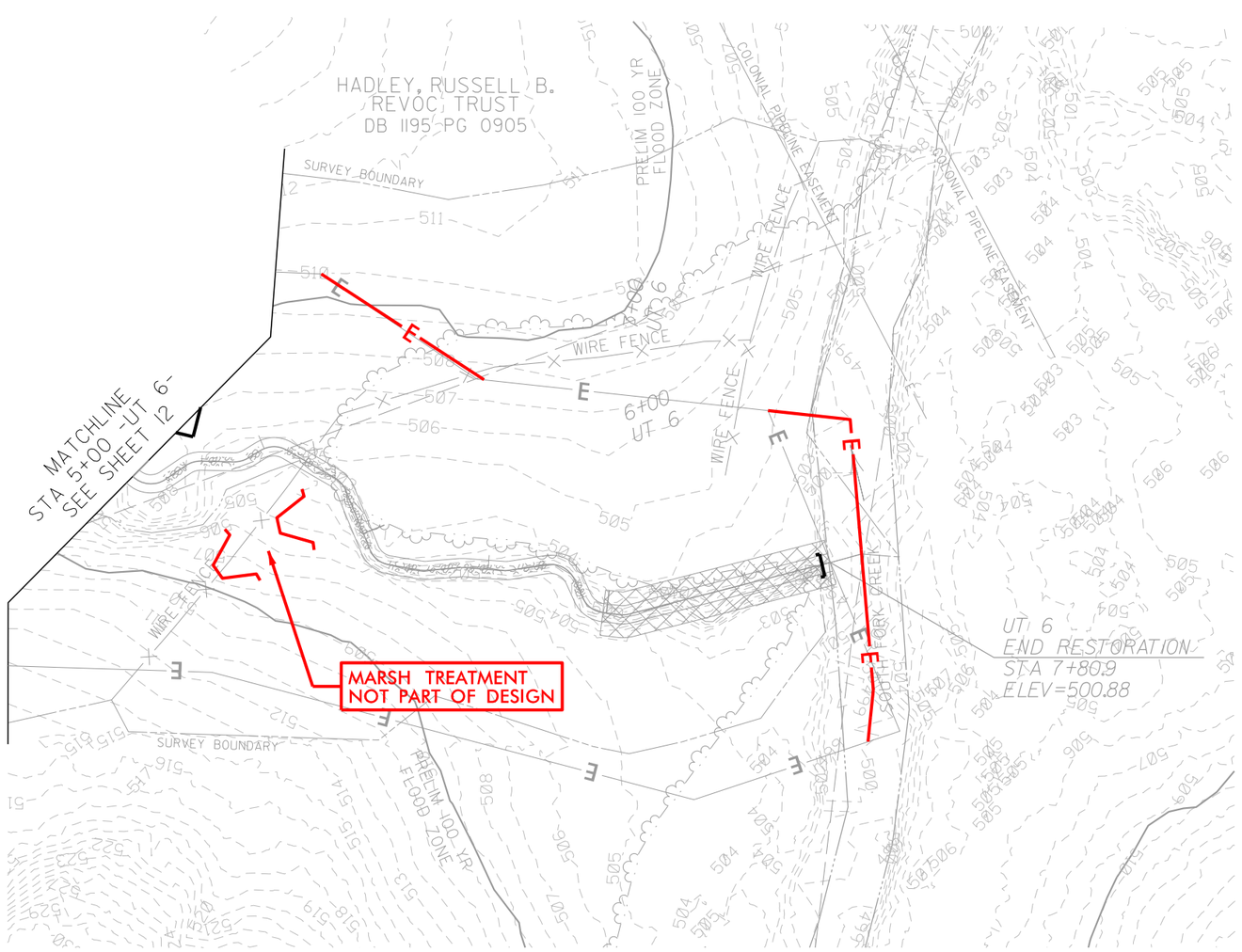

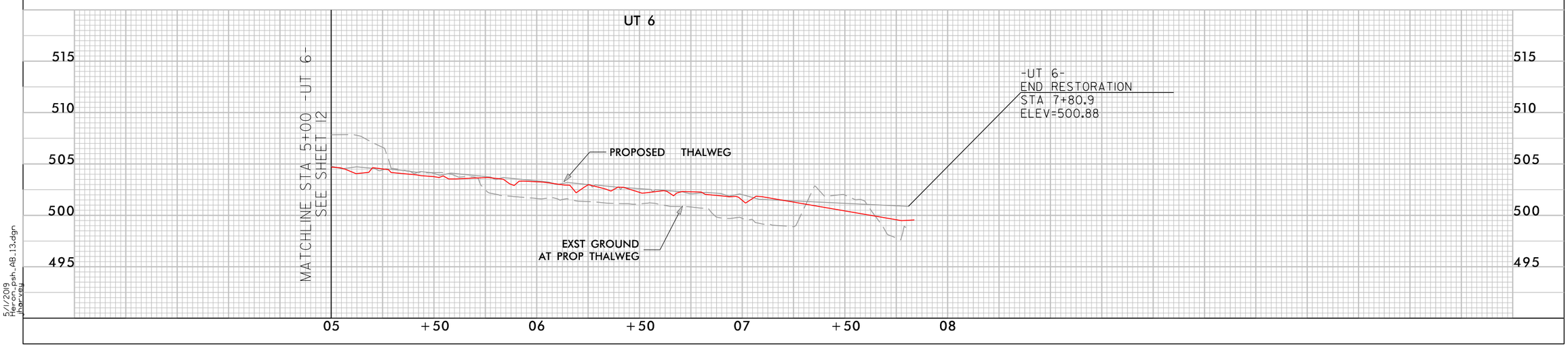

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	14

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE
COUNTY: ALAMANCE DATE: 2019

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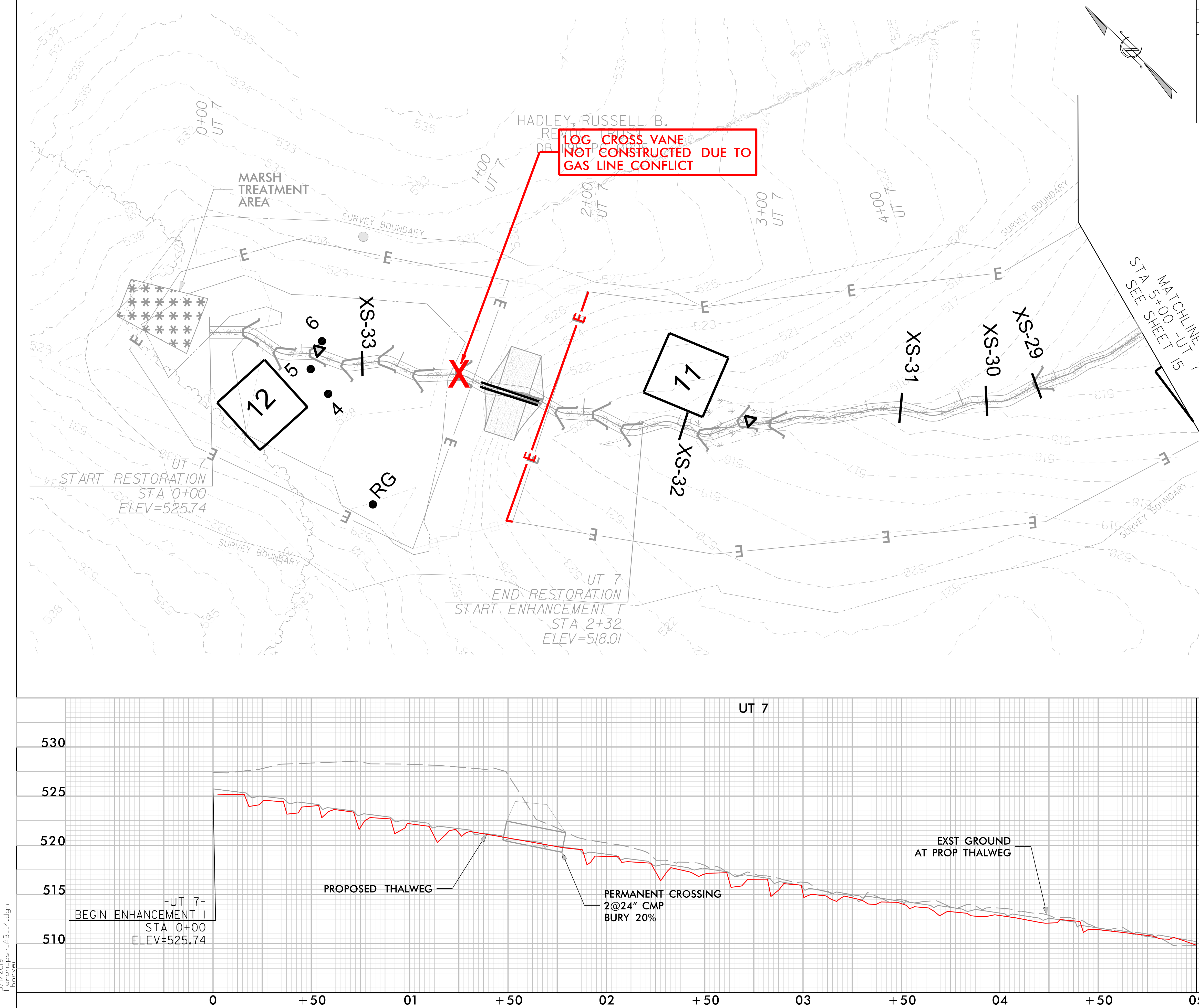

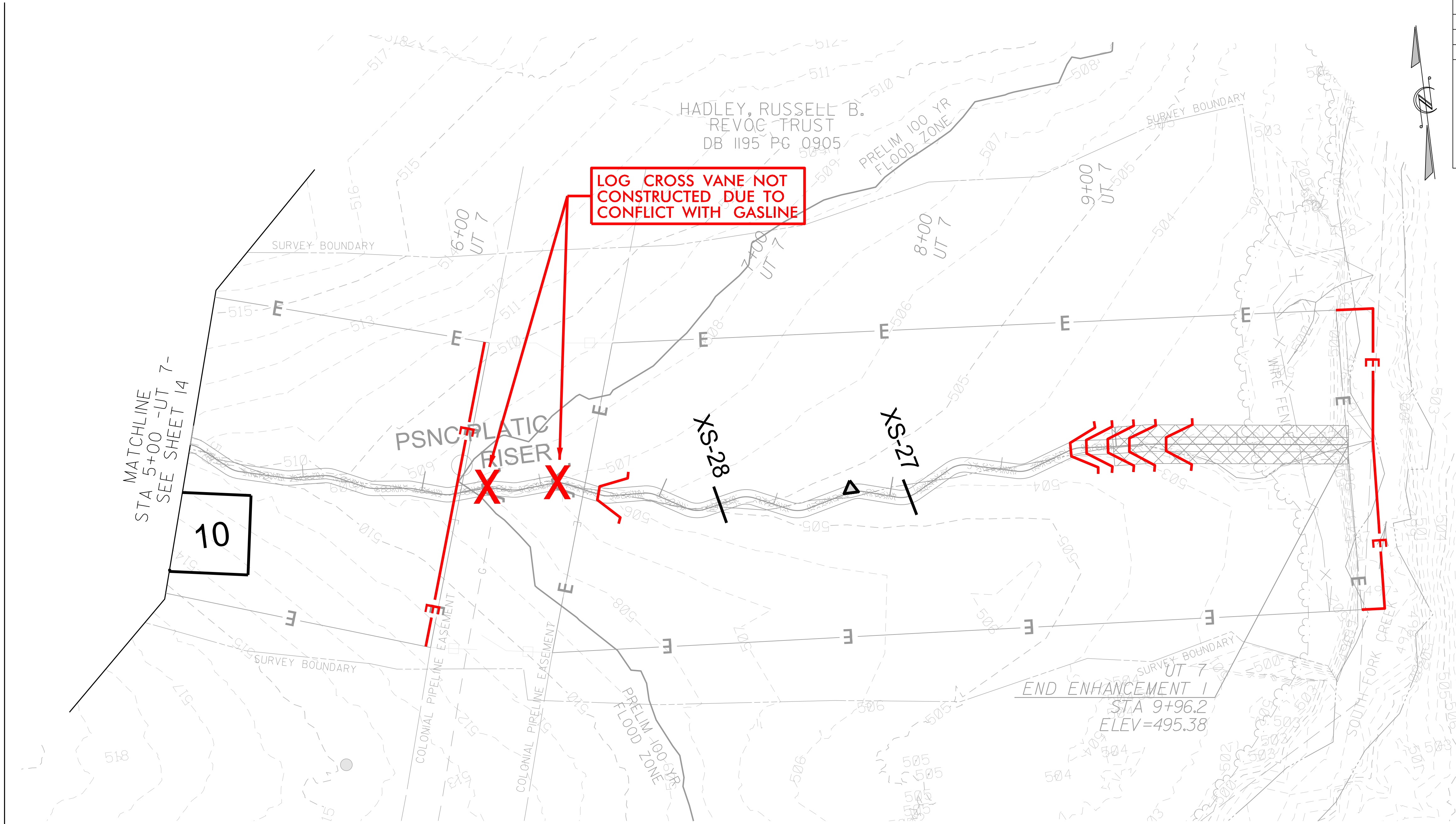

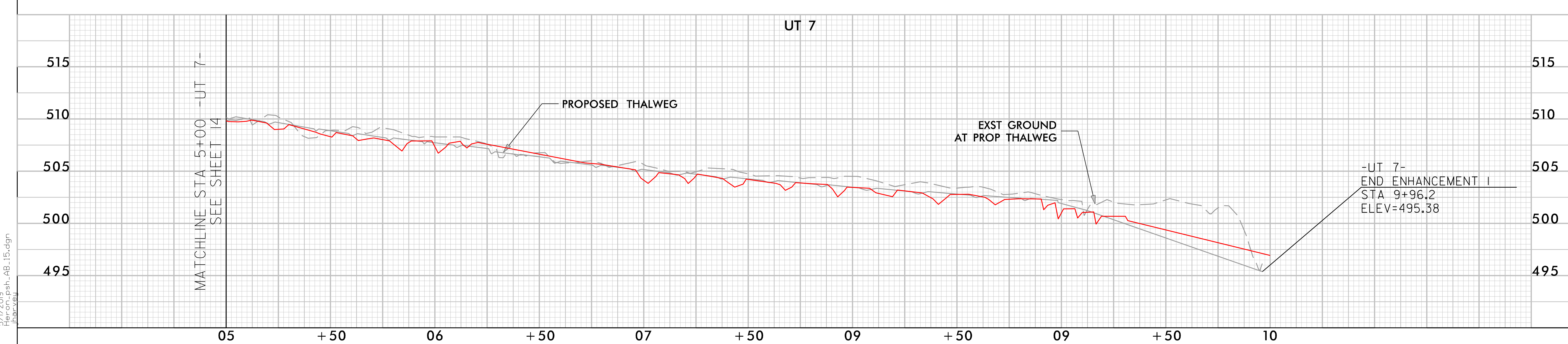

SHEET NAME: AS-BUILT STRUCTURES
SHEET NUMBER: 15
PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE
COUNTY: ALAMANCE
DATE: 2019

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	16

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE DATE: 2019

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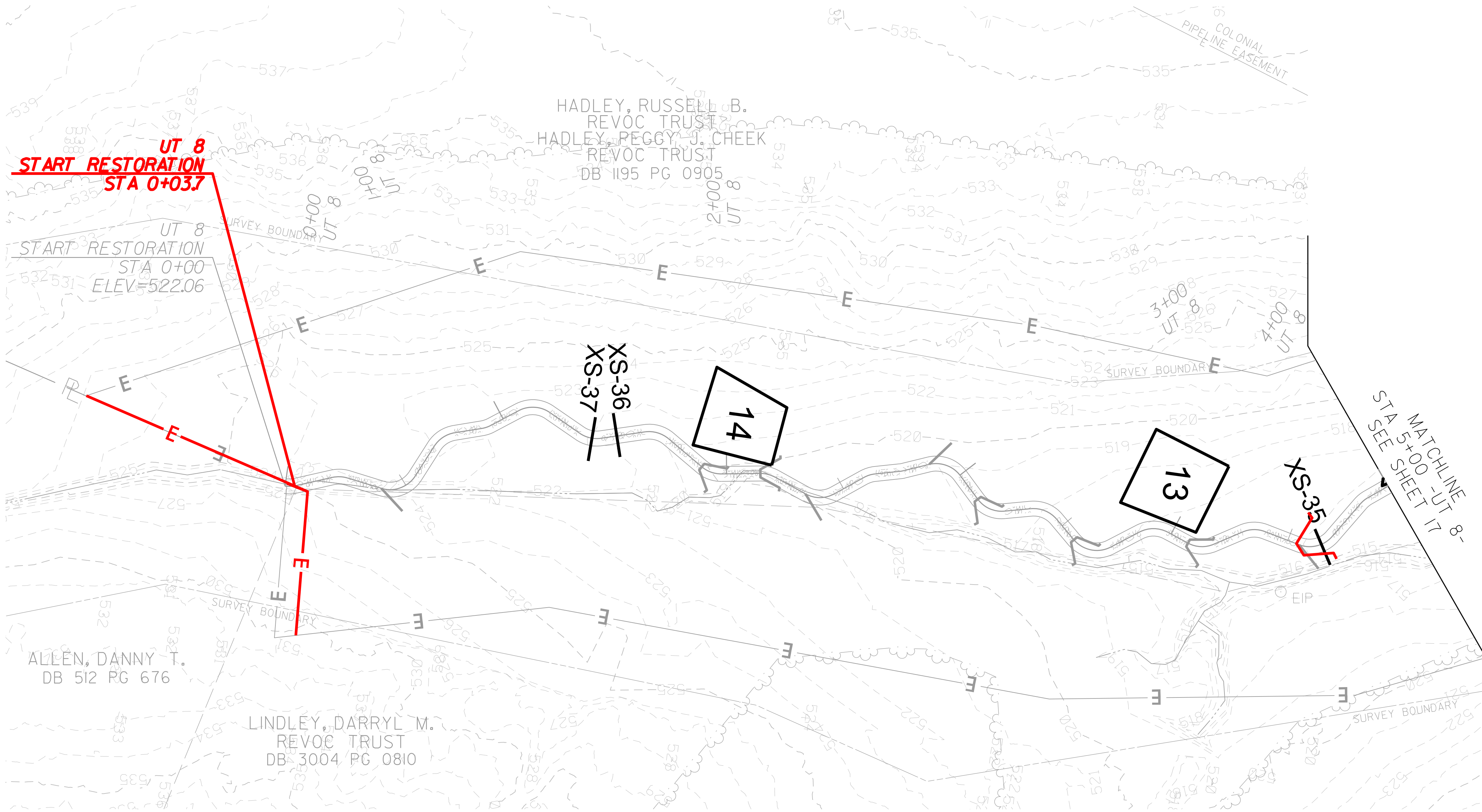

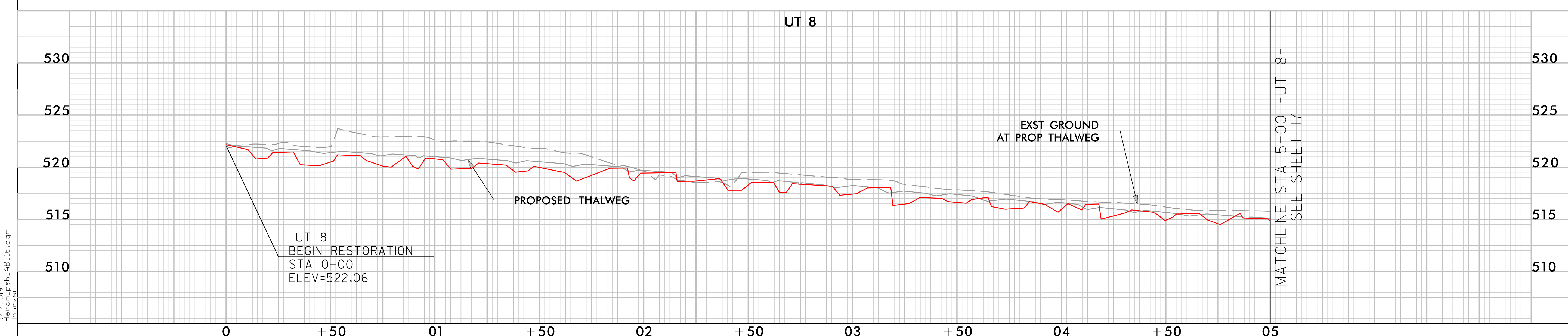

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SHEET NAME	SHEET NUMBER
AS-BUILT STRUCTURES	17

PROJECT NAME: HERON STREAM AND WETLAND RESTORATION SITE

COUNTY: ALAMANCE | DATE: 2019

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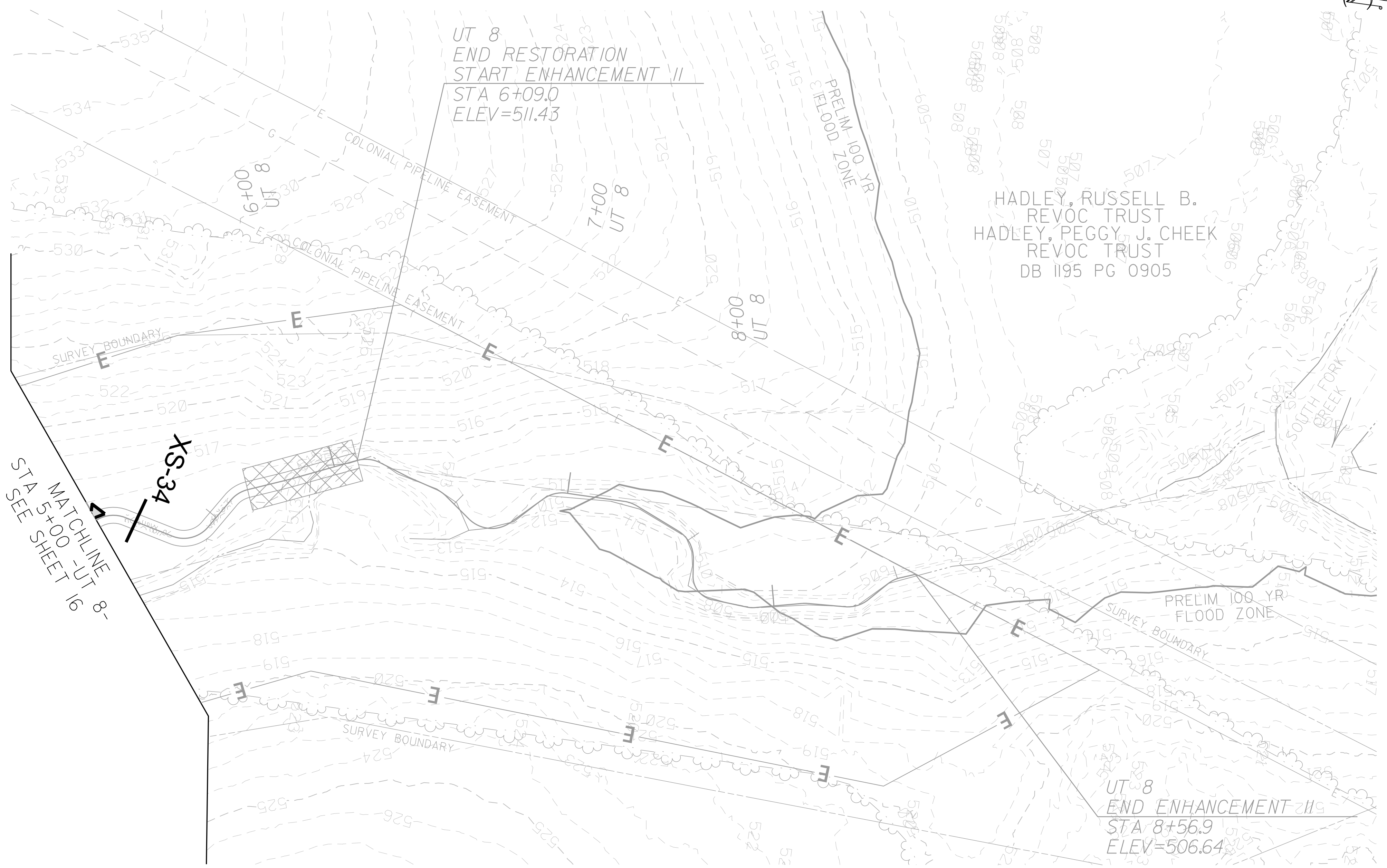

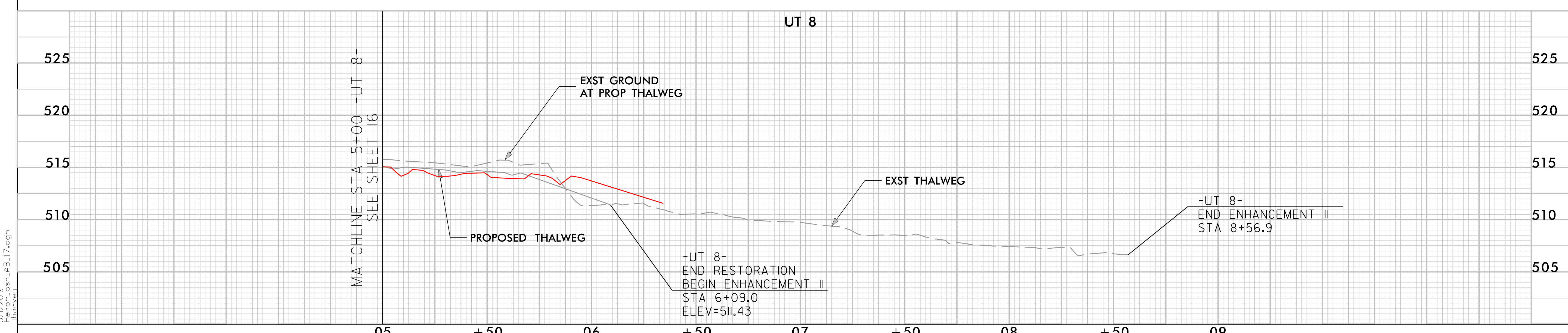

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jharvey

June 3, 2019

NC IRT
C/O Ms. Lindsay Crocker
NC DEQ – Division of Mitigation Services
1652 Mail Service Center
Raleigh, North Carolina
27699-1652

Subject: Formal Request to Modify Heron Mitigation Site Assets
USACE Action ID No. SAW-2017-01471
DWR No. 17-0290
RFP No. 16-006990
Mitigation Plan Assets—5,264 SMU
Amended Mitigation Plan Assets—5,293 SMU

Construction changes during As-Built provided an additional 29 SMUs from Mitigation Plan. Deviations from the construction plans included realignment of UT 1B (adding 20 linear feet to the alignment) due to conflicts with a gas line crossing. The realignment resulted in the reduction of a log vane and alterations to pipe configurations within the crossing. Gas line realignment also affected the length of UT 2 in its lower reaches (shortening the Restoration reach). UT 2 also has minor deviations in the enhancement II reach due to profile elevation alterations to tie to the invert of UT 1B. These profile alterations were included in construction plans, but not included in table updates of the detailed plan. Profile alterations resulted in the Enhancement (level II)/Restoration initiation point migrating upstream, and thus the length of the Enhancement (Level II) reach (UT 2A) decreased by 39 feet, and the length of the restoration reach (UT 2B) increased by 17 feet.

Minor easement deviations after construction plan development resulted in some stationing changes, most notable at the upper reaches of UT 1A (adding 5 linear feet to the alignment) and UT 8A & UT8B (reducing the alignments by a total of 4 linear feet). The easement variations also affected channel lengths across gas lines, which do not generate mitigation credit. Eight log cross-vanes were not constructed due to contact with bed rock, or conflicts with the gas line. In addition, a marsh treatment area was added to the right bank of UT 6 at a draw that was concentrating surface drainage and scouring the valley walls. No other deviations of significance occurred between construction plans and the as-built condition. In addition, no issues have arisen since construction occurred. Revised Asset Table is attached.

Thank you,

Worth Creech

Table 1. Project Components and Mitigation Credits
Heron Restoration Site

Reach ID	Stream Stationing/ Wetland Type	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Restoration Footage/ Acreage	Restoration Level	Restoration or Restoration Equivalent	Mitigation Ratio	Mitigation Credits	Comment
UT 1A	(-)0+05 to 04+70	475	470	475	Enhancement (Level I)	475	1.5:1	317	
UT 1B	04+70 to 13+26	753	836	856	Restoration	856-57= 799	1:1	799	57 lf of UT1 is located outside of the conservation easement and therefore is not generating credit
UT 2A	00+00 to 03+04	304	343	304	Enhancement (Level II)	304	2.5:1	122	
UT 2B	03+04 to 03+67	19	46	63	Restoration	63	1:1	63	
UT 3	00+00 to 02+79	269	279	279	Restoration	279	1:1	279	
UT 4	00+00 to 04+50	485	450	450	Restoration	450	1:1	450	
UT 5A	00+00 to 09+52	422	952	952	Restoration	952-52= 900	1:1	900	52 lf of UT5 is located outside of the conservation easement and therefore is not generating credit
UT 5B	09+52 to 14+90	538	538	538	Enhancement (Level II)	538	2.5:1	215	
UT 6	00+00 to 07+81	683	781	781	Restoration	781	1:1	781	
UT 7A	00+00 to 02+32	0	232	232	Restoration	232-41= 191	1:1	191	41 lf of the UT7 restoration reach is located outside of the conservation easement and therefore is not generating credit
UT 7B	02+32 to 09+96	764	764	764	Enhancement (Level I)	764-55= 709	1.5:1	473	55 lf of the UT7 enhancement reach is located outside of the conservation easement and therefore is not generating credit
UT8A	00+04 to 06+09	549	607	605	Restoration	605	1:1	605	
UT 8B	06+09 to 08+57	248	250	248	Enhancement (Level II)	248	2.5:1	99	
Wetland R	Riparian Riverine	--	0.35	0.35	Restoration	0.35	1:1	0.35	Wetland Restoration
Wetland E	Riparian Riverine	0.61	0.61	0.61	Enhancement	0.61	2:1	0.31	Wetland Enhancement